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Electrical Export Hopes

FOR several years past British electrical engineers have concentrated somewhat closely upon development work and trade within the United Kingdom. Two things have been responsible for this. First there has been the big expenditure amongst our own manufacturers upon the planning of electricity supply upon more up-to-date lines. Secondly, the general unsettlement throughout the world has made expenditure by some overseas customers, even for normal requirements, difficult, and in cases impossible, while all sorts of useful electrical engineering projects for which the world has long been waiting have remained in a state of suspense. It has been fortunate that the big expenditure at home has produced business at such a time as this.

But the moment has arrived when, having regard to the interests of the electrical profession and industry as a whole, we should ask whether it is wise to allow the grid to continue more or less as an obsession. To detail the numerous branches of electrical work upon which thousands of engineers and traders are engaged apart from the grid is unnecessary.

We should once again concentrate on electrical export trade. As we see it, the opportunity for doing so is arising just when the need is greatest—colonial and foreign orders coming to fill up the bays where grid production work is lacking.

We do not expect an immediate influx of foreign contracts, although there are indications of a revival. If the process of clearing up continues in certain markets which have been past purchasers of British electrical goods on a substantial scale, things should improve for the industry at home.

The opinion has been expressed lately by a leading manufacturer that sooner or later saturation must occur in the home market. That view has seldom been expressed in the past, the reason being that we always had in prospect extensions of plant and cables all over the country for many years to come—work that in actual fact has been concentrated into a brief period. This home saturation will not apply to some products for a long while, but we are urged to use our research and energy to develop overseas trade to take the place of products for which the demand has fallen.

As a journal which has always had a substantial following among overseas electrical buyers—engineers responsible for big construction and traders dealing in small products—we wish to lay stress once more upon the fact that the exceptional practical experience that has fallen to British electrical manufacturers owing to grid construction orders of the past few years has made them better equipped than ever to carry out such works in the various countries overseas where so much still remains to be done.

Between the years 1924 and 1933 the electrical exports of the United Kingdom reached close upon twenty million pounds per annum on two occasions. It will require keenness and energy to secure such totals again even with Poland and Russia coming into our plan of operations and India and Africa yielding better business.

Hackney's New Chief

WE congratulate Mr. E. A. Mills, of Halifax, on his appointment to succeed Mr. L. L. Robinson as borough electrical engineer of Hackney. To follow such a man as Mr. Robinson is no easy matter, and no slight honour, for we suppose there is hardly another electricity undertaking that has borne the impress of its chief more definitely right from the inception until his age for retirement. It is to be regretted that the committee made a slight error of judgment in its procedure regarding the appointment of the new engineer. As it was so perfectly plain that a man of special qualifications and experience was needed to control so large and increasingly important a system, it would have

been better if an age limit had not been stated. The age stipulated was under forty-five years, but Mr. Mills was recommended on account of his record, although he had reached the great age of forty-eight. In the Council meeting the critics held that in the circumstances the position should have been readvertised without a limit, thus giving every electricity supply man over the age of forty-five an opportunity of putting in for the job.

A Wise Decision

Too many local authorities look upon their electricity undertakings as a source of income, instead of as a public service. Large profits are aimed at to enable the rates to be "assisted," and thus an additional burden is imposed upon those ratepayers who happen to use electricity. Just now municipalities all over the country are busy "earmarking" some of their electricity surpluses for the rates, with the agreement of all parties, and we are glad to record the good example set by Exeter. It was proposed at last week's meeting of the City Council that £2,000 should be transferred from the electricity funds to the general rate, but this was rejected, the view being upheld that if large profits were being made the reduction of prices should be the first consideration.

Water Heating and Load Factor

WE draw attention this week to the new water-heating installation in a hairdressing establishment, not only because of the profitable field indicated for electrical development, but also because of the relevant "barber's chair publicity" value of such installations. The base and booster heating arrangements bring to the front again the load-factor question. The manufacturers tell us that a 20- or 30-gal. water heater may be fitted with a 750-W base heater and a 1,500-W booster heater with such a thermostatic setting that normally the base heater is in service from 15 to 20 hours per day. Most domestic hot-water installations have a maximum demand on probably only one day per week, so that with a low base loading a very good load factor can be achieved and rapid recuperation permitted by "boosting."

Domestic Ventilation

A WRITER in an architectural journal criticises as hygienically unsound the claim sometimes advanced that no flues are required in an all-electric house. We know, too, that this view is held by some electrical men. While much can be saved in building by dispensing with the means for getting rid of the products of combustion from other heating methods, we believe that the strength of the argument is considerably lessened by such suggestions as that adequate ventilation can be secured by opening a window, though this is not always possible without draught or noise nuisance. The requirement that not less than 100 sq. in. of aperture or air shaft must be provided in a room without a fireplace is not definite enough as a guide for obtaining the best atmospheric conditions. The drawing-up of some practical recommendations on the ventilation of the all-electric house presents an immediate task to the electrical industry.

Our Competitors

THE changing conditions of the past year in the United States and Germany are reflected in their electrical export trade figures, which naturally possess particular interest for British manufacturers, as they were for many years our chief competitors, both in this country and in certain overseas markets. The electrical export trade returns for Germany, given in detail on page 315 of our last issue, showed that such exports fell in 1933 to considerably less than one-half, both in weight and in value, what they were in 1929. Some reports from America suggest a healthier state of affairs than a year ago, and the President has brought forward proposals for adjusting the tariff for the revival of international trade, but the increased cost of production under the N.R.A. may prove a more substantial handicap internationally than nationally. Against the German figures we must place the fact that our own electrical export drop between 1929 and 1933 was from 19½ millions to about 9½ millions.

Central England

THE starting of trading conditions under the grid in Central England next month will bring a welcome addition to the generating pool of the country. Apart from Ironbridge, for which official data are not yet available, the selected stations include three with thermal efficiencies of over 20 per cent.—Hams Hall, Longford and Spondon—and four more of over 18 per cent. The heavy work involved in the frequency change over has not unduly held up interconnected working of the power-stations. What is even more to the point, it has not held up consumer development in the area, as the remarkable figures given by Sir Percival Bower at the E.D.A. dinner at Birmingham prove.

Let Everybody Know!

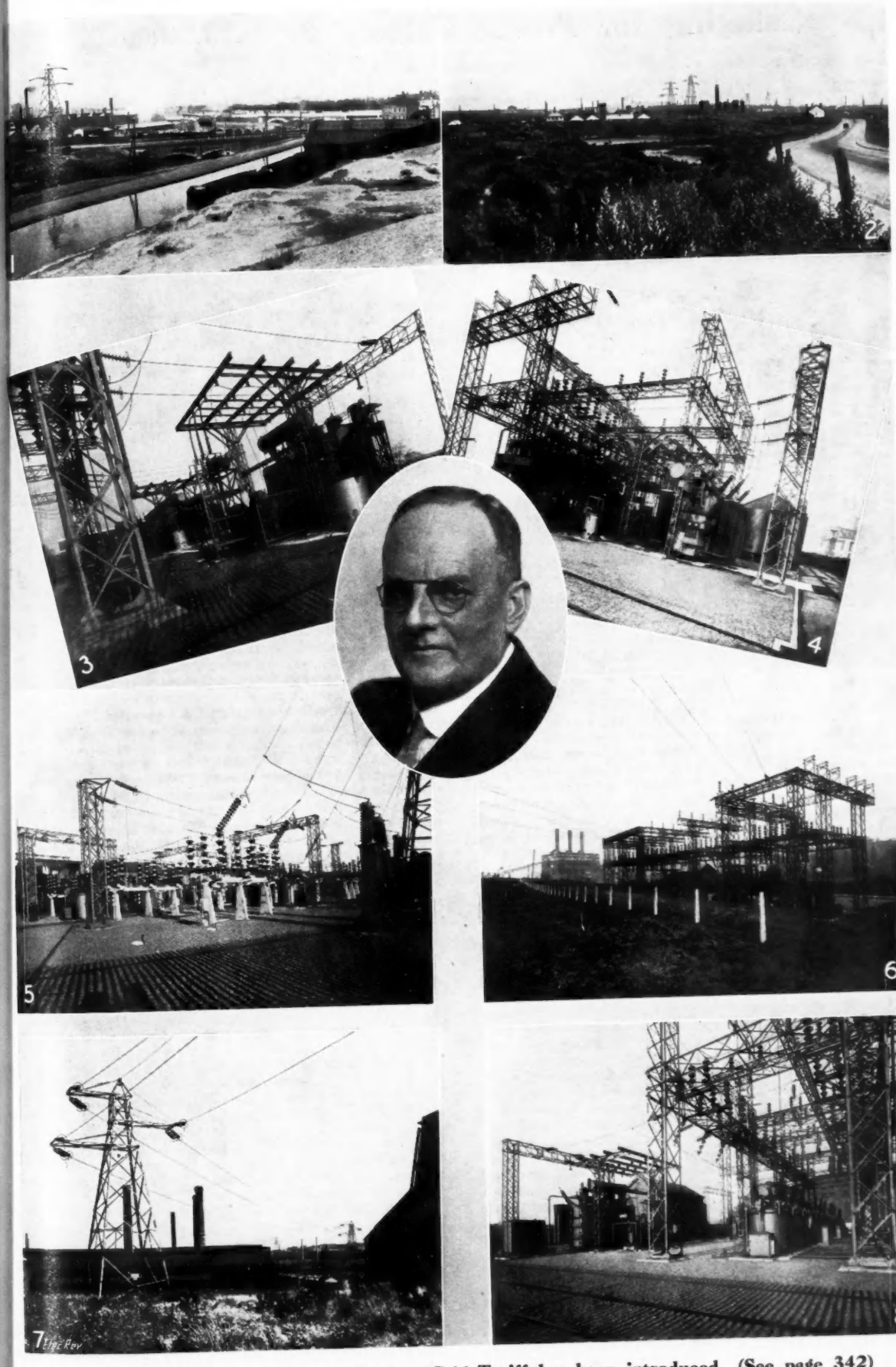
WE do not know that it is a habit of the individual electrical contractor to hide his light under a bushel, but for some reason or other his organised association seems to prefer darkness to light. Were it otherwise, why should it bury its gems in the general heap of matter contained in its official journal? There is nothing to be ashamed of, for instance, in deciding to hold its annual conference in June next at Buxton, with the Palace Hotel as its headquarters, nor does there appear to be any reason for exclusively keeping to itself the news that the E.C.A. and all other sections of the industry, "with the exception of the I.M.E.A.," were, in conjunction with E.D.A., favourably disposed to the idea of a national electrical convention this year, and that they favour the making of further efforts to secure a combined gathering in 1935. Who said co-operation? Another gem flashes out the impatience felt by the E.C.A. with the reconstituted E.D.A. for not more expeditiously setting up "the consultative committee which had been visualised."

Heat Transference

WE wish the term "radiator" had never been introduced to describe an electric fire. It associates heat radiation too exclusively with luminous properties, and is also apt to cause confusion between non-luminous radiation and convected heat. Exaggerated ideas as to the slowness of the electric boiling plate are probably caused by vagueness with regard to the different ways in which heat transference may take place. In this case the question is primarily one of efficient heat conduction, which presents perhaps the most difficult problems of any, some of which Mr. C. Baxter deals with in an article in this issue. One of the most obvious of these difficulties is the loss of efficiency due to unequal coefficients of expansion between the different components of thermal apparatus. The consumer should always be protected against nomenclature that has a technical bearing. Is not the expression "low-temperature" heating, for instance, open to the objection that to the man in the street it may seem a contradiction in terms?

Lightning and Wood Poles

LIGHTNING is infrequent in this country compared with many others, but it has been found more troublesome than has at times been expected. In some parts of the United States there is an average of eighty thunderstorms per annum, and an investigation just reported by the Edison Electric Institute presents an intensified view of their effects on protective methods. The earthing of each wooden pole and its cross arm, in addition to the use of an overhead earth wire, appears to protect the pole from injury but materially to increase the risk of interrupting the supply, owing to the reduction thus brought about in flash-over values. The cost of repairing the damage is small, and is in any case unimportant compared with the need to preserve continuity of supply, so that individual-pole earthing should be kept to a minimum.



The Central England Area for which a Grid Tariff has been introduced. (See page 342)

1. The grid at Birmingham. 2. A section near Wolverhampton. 3. The Bartley Green sub-station. 4. The Spondon sub-station. 5. The Warwick sub-station and terminal tower. 6. Ironbridge sub-station with the power station in the background. 7. A line from Ocker Hill sub-station. 8. A line of oil switches at the Coventry sub-station. Inset: Mr. S. T. Allen (*Elliott & Fry*) who is in charge of the Area

Charging for Power Factor. By D. J. Bolton

The cost of low values

THE present article is concerned only with the power-factor aspect of electricity supply tariffs as an introduction to a comparison between the usual consumer tariff and the "grid" power-factor penalty. As a preliminary the actual costs of supplying bad power factors must be briefly considered.

The costs of supply at any point on a system are made up of four portions, namely, the fixed and running costs of generation, and the fixed and running costs of transmission and distribution. The running costs are only affected by bad power factors to a very minor degree. The fuel and other running portions are obviously dependent only on the true energy generated, not on the kVAh; but some of this energy does not reach its destination, and the difference (*i.e.*, the losses) will be a function of current squared, and, therefore, affected by power factor. Since the total losses from alternator windings to consumers' terminals do not amount to more than 20 per cent., the additional running cost attributable to bad power factor is almost negligible. In fact, very few two-part tariffs make any alteration in the running charge on account of power-factor variations, although occasionally a bonus/penalty clause is applied to the whole bill instead of merely to the fixed charge. With flat-rate tariffs the undertaking has no option but to charge power-factor on the whole bill.

[*Elliott & Fry*

Mr. D. J. Bolton, M.Sc., M.I.E.E.

Generation and Distribution Costs

Fixed costs of generation are made up of capital charges, management, &c., costs and certain proportions of the fuel and wages. If two similar stations were built for the same maximum load in kW, one of them to work at unity and the other at 80 per cent. power factor, they would both require approximately the same amount of land, buildings, boilers and turbines, but the second would require 25 per cent. larger alternators and switchgear. Probably something less than one-third of the total capital expenditure would thus be proportional to kVA rather than kW and the capital charges would be in the same proportion, whilst the management and other allocations might be in the same or a somewhat higher ratio. As a rough basis of calculation, then, it may be reckoned that between one-quarter and one-half of the fixed costs of generation will be proportional to kVA demand, the remainder being unaffected by power factor and dependent only on kW.

Once a station has been built and designed for a particular power factor, say, 80 per cent. (*i.e.*, with the electrical plant one-and-a-quarter times the capacity of the steam plant), any demand at a lower power factor will represent a demand on the station as a whole not merely on the electrical plant, since electrical and mechanical are present in a fixed ratio. Apparent kVA would then cost fully as much as true kW.

But in these circumstances it will be cheaper to install load-factor improvement plant rather than have the effective capacity of the whole station reduced in dealing with a low power-factor load. The cost per effective kVA of such plant will certainly be less than the cost per kVA of the whole station, and probably less than the cost per kVA of the alternators—*i.e.*, even if it were known before the station was built that the power factor of the load would be less, it would be cheaper to design for operating with phase-advancing plant and alternators at 0.8 than with larger alternators working at the load power-factor. Such an arrangement is also more flexible, and a virtual necessity in an interconnected system. It would therefore appear that, whether dealing with a projected station or with one already built, the fixed costs affected by power factor should lie between one-quarter and one-half, as already estimated.

Turning now to transmission and distribution costs, the plant employed is in two groups—that in which the output is limited by heating considerations (underground transmission lines, switchgear and transformers), and that in which regulation is the limit (overhead lines and distribution networks). The size of the former is a direct function of current, whether that current is in phase or not. In the case of the latter the position will depend on the value of the line constants, but in general the cost of a lagging kVA will be at least as high as the cost of a kW. The same remarks will apply to the operating and management expenses, which usually rank entirely as fixed costs. For the present purpose it will be sufficiently accurate to regard all fixed costs of transmission and distribution as directly proportional to kVA.

It follows from the above that in an undertaking where the generation costs are rather less than one-half of the total expenses, the cost per kVA of consumers' demand will be of the order of three-quarters of the cost per kW. The position as regards costs may then be summarised by saying that the cost of supplying the kVA of lagging demand (expressed as a ratio of the cost per true kW) will be about one-third at the station bus-bars, and will rise to about three-quarters at the consumers' terminals.

Tariffs

Tariffs are in two main groups, so far as power-factor modifications are concerned, namely, kVA tariffs and bonus/penalty tariffs. In the former case the fixed charge is based on kVA pure and simple, each lagging kVA costing as much as a true kW. It has been seen that this results in an over-penalisation of bad power factors, since the costs are not in this full ratio. It is true that there is a slight under-penalisation in respect of the "unit" charge, which is based only on true kWh, but it is easy to show that this is not sufficient to balance the other. The advantage of the kVA power-factor tariff is that it is simple both to meter and to explain, since only one quantity is involved in the fixed charge portion.

In the bonus/penalty type of power-factor tariff a certain middle value of power factor is adopted as a median, and values above and below this figure are rewarded and penalised by a proportional variation either in the fixed charge or in the total bill. This type of tariff has the advantage that it is much more flexible than the other, since the penalty can be made of any desired magnitude instead of this being tied to one particular value. The disadvantage is that two quantities are involved, one of them being power factor, and two measurements are needed for the fixed charge.

While the kVA method of power-factor penalisation is possible only when a two-part tariff is employed, the bonus/penalty method is applicable either to a two-part or to a flat-rate tariff. When applied to a two-part tariff the penalty may be attached to the fixed charge only or to the whole bill. In a flat-rate tariff it can only apply to the bill as a whole. Since the costs of bad power factor are almost confined to the fixed expenses, it is wrong in principle to impose a penalty on the whole bill, and will inevitably lead to injustice in its application, particularly to consumers having a good load factor.

Operation of the Bonus/Penalty Clause

This can easily be seen by taking two consumers with the same maximum demand and the same power factor, one having 20 per cent. load factor and one having 40 per cent. On a flat-rate tariff, with a bonus/penalty clause, the latter will pay twice the power-factor penalty of the former since his consumption is twice as great. Yet the expenses involved in his bad power factor (since they are almost entirely fixed costs and therefore a function of maximum demand) will be very little greater than those of the other consumer. With a two-part tariff having a bonus/penalty on the whole bill, the disparity between their power factor charges will still exist although not so much as with a flat-rate tariff. On a two-part tariff in which the bonus/penalty only applies to the fixed charge the disparity will not occur, and no injustice will be done as between different load factors.

The result of applying a bonus/penalty clause to a complete bill, rather than to the fixed charge only, will be to change not only the incidence of the penalty but also its magnitude. Consider, for example, a two-part tariff in which the numerical ratio between the price per kW per annum and the price per kWh has a value of 15 (a fairly usual figure). With an average power consumer, having a load factor of 20 per cent., the fixed charge will then represent just two-thirds of the whole bill. A bonus/penalty (for a given power-factor variation) of, say, 15 per cent. on the fixed charge will then amount to the same thing as two-thirds of 15, *i.e.*, 10 per cent. on the whole bill (whether two-part or flat-rate).

There is no lack of examples of power-factor tariffs. A recent survey was made of two-part tariffs put forward for industrial power supplies by authorised undertakings, excluding those whose total sales were under a million kWh a year. It was

found that in twenty-two cases out of thirty-five (nearly two-thirds of the whole) the fixed charge was based on kVA instead of kW. On the other hand, bonus/penalty clauses appear in hardly any of the published tariffs, either two-part or flat-rate, although they are doubtless sometimes made a condition of the special power terms supplied "on application" by a number of supply authorities.

Probably the best, and certainly the most important, example of this type of power-factor charging is the "grid" tariff. The actual figures differ slightly in the different areas, but taking a rough average and making some allowance for the reductions in fixed charge with growth of load this charge may be put as £3 per annum per kW, with an addition of 4s. 6d. per kW for each 0.1 power-factor reduction below 0.85. The running charge is not affected by power factor, and may conveniently be left out of the calculation entirely.

Besides these two main types of power-factor tariff there are sundry frills and modifications, some of which turn out on inspection to be merely old friends in a new dress, and have no right to an independent existence. In the meantime, we can at least avoid adding to the confusion by giving different names to the same thing.

Electro-thermal Apparatus.

By Charles Baxter, A.M.I.Mech.E.

Notes on design and construction

IN reviewing the position reached to-day in the branch of electrical engineering dealing with the design of electro-thermal apparatus, one is apt to look back upon the days when flat irons were fitted with the solid embedded-type element, fires were composed of inartistically arranged receptacles utilising thin wire elements of variegated types, and cookers incorporated boiling plates comprising spiral elements threaded through holes in bars of refractory material. Most of these articles were unreliable, chiefly due to the unsuitable material composing the resistance wire, but with the advent of more perfect metallurgical compositions, such as nichrome, things took on a new aspect.

Mr. Charles Baxter

After the most essential improvement in element alloys had been brought about, the appearance of apparatus was very much improved, but technical progress soon appeared to have slowed down. In a manner this was true, as the conversion of electrical energy into heat is so convenient and simple, being, in fact, one of the first effects to be noticed in the science, that once the spectre of unreliability had been laid little else seemed possible. This is more apparent than real, however, as once various technical points have been thrashed out, or become more commonplace, certain advances will be made which will not only improve existing apparatus but extend considerably the available field.

The main aim is efficiency, and that, in certain cases, implies producing devices which will do their work not only cheaply but also more conveniently or pleasingly. Everybody does not take kindly to improvements as they change styles of manufacture and have other effects, especially if they involve a reduction of energy. I once designed an iron which would do the work of a 400-W type with 275-W loading, and in a better and more convenient way. It was just the ordinary type of iron incorporating a few improvements and a more scientifically designed and arranged element. I was asked point blank if I thought supply undertakings would sell irons consuming less energy!

The work and research entailed in producing such improvements are not always lost, as shortly afterwards I was approached by a large firm of, I will say, oil-cloth manufacturers, who were using platens some seven feet by ten feet previously heated by gas, with a view to my designing similar ones incorporating electric heating. This kind of thing is quite possible if skilfully carried out, but it had apparently not been successful previously owing to cracking and warping troubles. One wonders how much day load is being lost, considering the vast number of firms scattered all over the country using such contrivances.

The problems involved in this case, and all others, whether the articles be irons, platens, radiators, or cookers, are simply those of heat generation, control, travel and diffusion. In most instances the generation is a simple matter, as with the possible exception of a small loss by luminous radiation all the energy put into the appliance is given out as heat. The temperature reached by the element depends upon the rate of the I^2R expenditure and of its conduction and diffusion. Very important points crop up here, as, although alloys of the nichrome class combine good mechanical qualities and freedom from oxidation up to the region of 1,100 deg. C., if the facilities for conduction to the diffusing medium break down, the core temperature rapidly rises and the element burns out.

In the design illustrated in fig. 1a trouble occurs due to the difference in the coefficients of expansion between the refractory and the diffuser, causing a loss of intimate thermal contact between the two. A satisfactory design is indicated in fig. 1b, with a plan of one contour design in fig. 2a. Only practical experience can settle the latter, which, if not judiciously arranged, may result in a "bow" in large plates of as much as $\frac{5}{8}$ in., a distortion which would be fatal with some manufacturing propositions. Figs. 1c and 2c depict further faulty methods of slab heating, particularly fig. 2c, where there is little or no thermal path to the working face from the top slab.

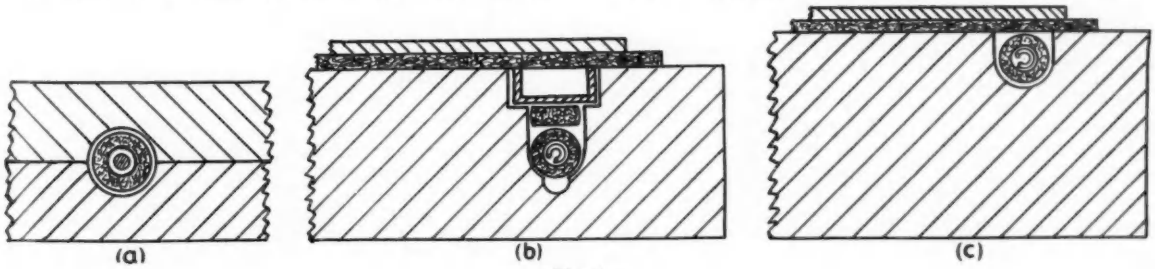


Fig. 1

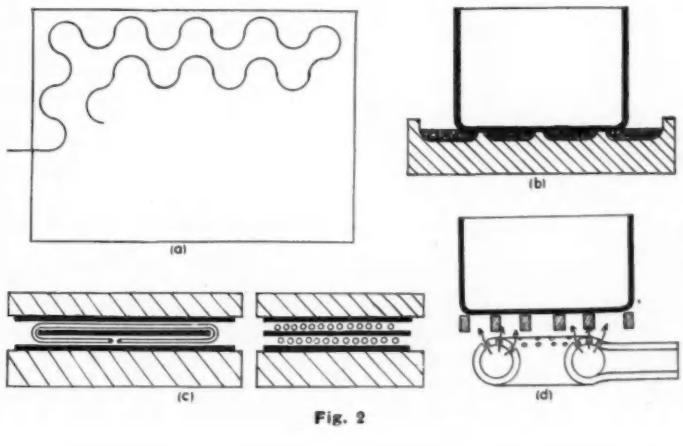


Fig. 2

Elements for platens may be divided electrically into two circuits, the heat developed in the first being proportional to I^2R; with two in series it is in proportion to $0.5I^2R$, and with the two in parallel $2I^2R$, thus giving three rates of 1 : 2 : 4

With such large slabs the initial heating is of moment and may, when lagged, be deduced from $H=SW(t_2-t_1)$B.th.u., where H = the calculated amount of heat required for a change of state from t_1 to t_2 deg. F, S = specific heat of the material, and W = weight of material in lb.

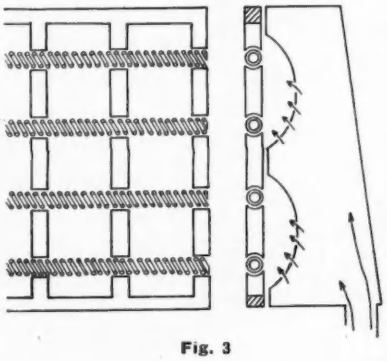


Fig. 3

Boiling Plate Difficulties

The second step of getting the heat from the point of generation to the diffuser is not so simple as the generation of the heat. In overcoming this difficulty we find one of the real paths of progress. The boiling plate is a typical example. Some makers pin their faith to radiant plus convected heat, as in the open plate, which requires pans with black bottoms as the boiling time may be shortened thereby by some 30 per cent. over that with the bright utensil.

Others favour solid plates of the embedded type, carefully machined flat, with thick utensils equally well machined, the whole working tolerably well in unison so long as the plate does not warp, or the pan is not dropped, knocked, or otherwise misused.

My experiments have indicated two directions for improvement. The first is to form a lip and studs on the solid type plate and to use a soft bedding of, say, an amalgam type (fig. 2b). Any kind of utensil can be used on this, the heat flow is nearly perfect, and when cold the low-temperature metal can be as solid as the plate.

The second improvement is in the experimental stage and involves a principle aiming at speed and delicate regulation. This comprises a specially designed tubular-type element (fig. 2d), containing holes for the current of air, which is highly heated by its passage through them. In cooking one continually requires speed and some gentle simmering process without hot spots, anything more drastic spoiling the job, and it seems that something after this style can provide it.

Fires and Radiators

With regard to space heating there are two schools of thought; the first involves the purely radiant type of heater and the second the usual radiation plus convection device.

Assuming we require to heat a room an hour or so before occupation, the radiant type has to diffuse the heat by first warming articles of varying specific heat values, not chosen for their convenience in this respect, and the result is not exactly perfect. In the second we have more success, but after occupying the room for some time we discover a stuffiness or dryness of atmosphere. This design may be styled the stove-type radiator, and it requires improvement in its diffusing properties. It runs at a high temperature and "roasts" the air.

Two methods have been available for circumventing the trouble, either increasing the area of emissivity for a given size, which means reducing the emissivity per sq. ft., or transmitting more of the heat as radiant energy. The first puts up costs of both materials and manufacture and is not perhaps advisable, especially as the user will insist upon some visual indication of the expenditure of energy. The second is readily brought about by the spiral reflector arrangement which provides the necessary optical illusion but incorporates drawbacks attending the purely radiant type.

The ordinary resistance-type fire is cheaply and easily manufactured and is robust, simple, reliable and homely looking, but it runs at a high temperature and dries the air. Moreover its air-circulating properties (which are important with any type of radiator and are non-existent with some) are too circumscribed, and practically consist of a column of air equal to the plan area of the device. Convection circulation is thus entirely insufficient and fig. 3 indicates a forced air-draught fire which can be designed to give advantageous characteristics. The draught having egress through the front enables a reflector to be used to provide the visual demonstration and similarly air circulation, and both radiant and mild convected heat are provided.

For such apparatus as platens and boiling plates it is essential to provide as easy a path as possible for the heat flow, first from the resistance alloy to the refractory, and then from this to the slab or diffuser. Owing to different expansion rates, this is not easy and to find materials with good insulating properties and high coefficients of thermal conductivity is also difficult. However, much improvement can be made in this direction by mechanical means, and by suitably locating the element in the diffuser almost any heat flow can be arranged for.

The first points mentioned, *i.e.*, easy heat flow and the contact (however it may be devised), are very important, as they govern the rate and speed of the transfer, which is limited by the gradient produced between the alloy and the diffuser. Any reasonable heat flow or speed could be provided if materials were available to withstand any temperature gradient, but at present we are limited by steep gradients which reduce the life of the alloy or element. If sound thermal contact can

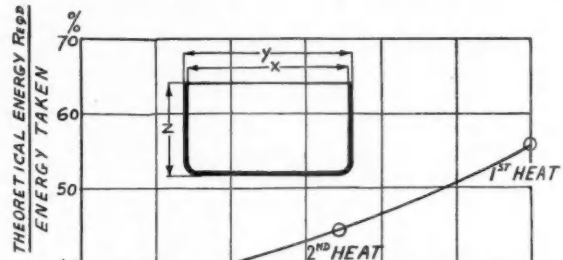


Fig. 4

be made and the flow quickly diffused or removed from the outside, the core temperature is not unduly increased for an increased flow.

Greater progress would be made if standard performance tests for apparatus were devised and agreed upon, and it is gratifying to see that more attention is now being paid to this matter. Fig. 4 indicates one form which I have evolved and no doubt there are others serving similar purposes.

A very important matter affecting all forms of electro-thermal apparatus is that of control. Elaboration increases cost, and there is much room for ingenuity in this direction. It greatly affects such operations as cooking, and eventually much attention will have to be given to it.

An 80,000-kVA 3,000-r.p.m. Turbo-generator

THE 80,000 kVA steam turbo-generator built by the Siemens-Schuckert Works, Berlin, for the power station of the Société Interescaut at Schelle, Belgium, is claimed to be the largest single-shaft machine running at 3,000 r.p.m. so far constructed. The set generates at 10,500 V at a power factor of 0.75, the excitation input being 121 kW.

The rotor is in three parts, the centre-piece or actual core, which is a hollow-forged cylinder, and the two flanged-on shaft ends. The rotor diameter is 3 ft. 3 in. and the length approximately 16 ft. 15 in. The hoods enclosing the coil ends are of non-magnetic alloy steel, and they are shrunk on to a seating on the rotor body. The coil ends are free to move and are secured against centrifugal action by the hoods. When the machine is at rest and still warm the coils are yet able to move, since the coil-ends are not rigidly secured to the core. Consequently, when the machine comes to rest, the internal compression stresses in the copper are free to expand themselves.

The stator housing is of the built-up type, the end-shields being of cast-iron and the end-plates of steel. The stator single-bar winding is composed of compensated component conductors with branched connections at the coil ends, and is connected in double star. The stator slots are open and designed as reactance slots with a ventilating duct at the top. The rotor weighs 42 tons and the stator with end-shields 114 tons. The unit weight is thus 4.3 lb. per kVA.

Cooling is effected by turbo-blowers on the generator shaft outside the stator housing, so arranged that before entering the generator the air passes through a re-cooler.

Electrical Musical Instruments. By R. W. P. Leonhardt

The influence of radio engineering principles

MUSIC which is reproduced electrically cannot entirely attain to the full quality of the original, since it is gained by converting acoustical (microphone) or mechanical (record) vibrations into electrical ones. There is a difference, however, if the initial vibrations are produced electrically before they are amplified and converted directly into sound through a loud speaker.

For this purpose four different electrical musical instruments have been developed in Germany and Russia. They are not to be confused with devices that are merely actuated electrically, like an organ or motor-driven piano, which utilises a perforated paper roll or a guided set of hammers which merely take the place of human hands.

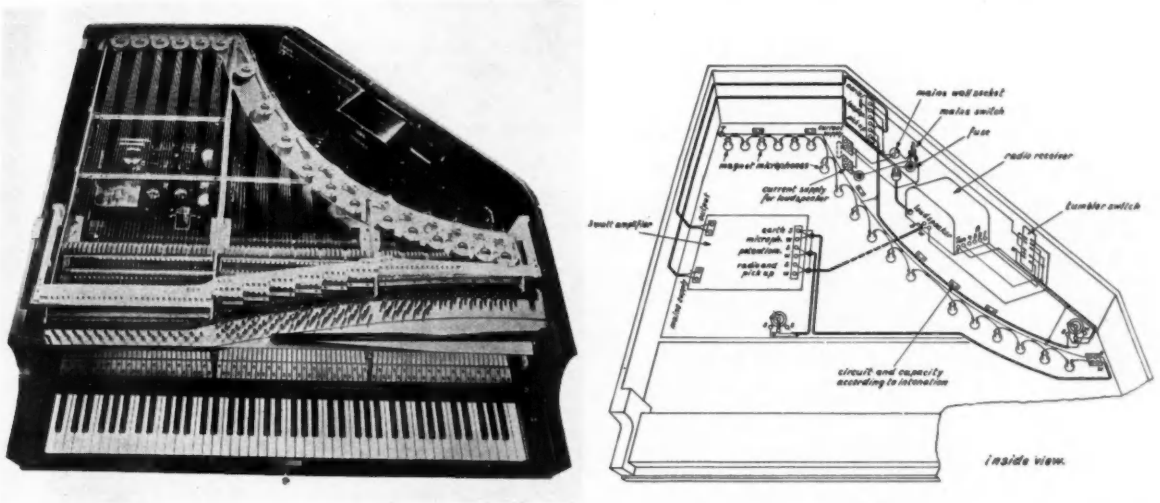


Fig. 1.—Inside view with explanatory diagram of the Siemens-Bechstein-Nernst grand piano; the microphones are to be seen at the far end of each group of strings

A Novel Piano

A grand piano developed by Siemens & Halske in co-operation with the Bechstein piano works, according to the directions of Prof. Nernst, of Berlin University, possesses a normal keyboard and standard steel strings of various lengths. Only the wooden sound-board and its acoustic effects are eliminated. (See fig. 1.)

Magnets with coils wound on them (so-called magnetic microphones) are attached to the ends of the strings, which thus vibrate in magnetic fields and cause electrical vibrations around the coils in accordance with the lengths of the strings. The advantage is that the vibrations thus produced can be amplified at will, and regulated by a volume controller coupled to the pedal. While not all the high harmonics of a piano are audible, a considerably larger number of them are produced than is usual, resulting, of course, in a harder tone. On the other hand, the tone "colour" of the piano may be adjusted artificially by neutralising these high harmonics by means of condensers, and, furthermore, the tone can be adapted to the taste of the player. The piano strings' fixed sounding period is adjustable by means of the pedal.

With the strings loosely coupled to the magnets a piano-like volume controller instead of gradually fading away. The output of the l.f. amplifier can be adapted to the requirements of the room, and when practising it is possible to cut out entirely the electrical part, in which case the piano sounds somewhat similar to a spinet. It is also possible to connect head-phones in place of the loud speaker, so that the person who is practising may check his own playing without disturbing his neighbours. The instrument possesses built-in radio and record-reproducing apparatus, the output of which can be passed to the l.f. (audio frequency) amplifier in the place of the vibrations produced in the magnetic microphones.

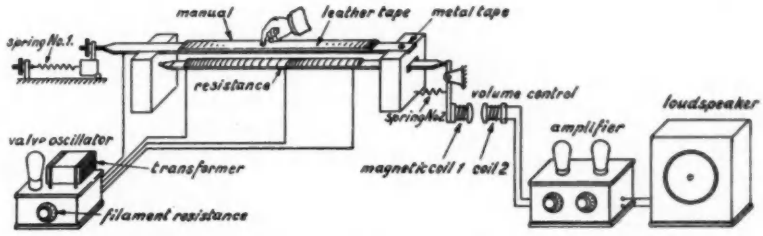


Fig. 2.—Schematic circuit of a single-note "Hellertion"

Other Types and the "Trautonium"

The Vierling grand piano developed by the Heinrich Hertz Institute, of Berlin, functions in a similar manner, but has not yet appeared on the market.

While these two pianos permit the sounding of several fundamental notes simultaneously, the methods described below allow only one note to be sounded at a time.

The "Hellertion," by Hellberger, of Frankfort a/M., consists of a standard piano with a special manual placed in front of the usual one. With the help of this the vibrations of a valve oscillator may be varied in frequency. Resistance coils are tapped in such a way that a succession of notes (*i.e.*, a scale) is sounded. The resulting music is of a somewhat peculiar character, and, to be fully appreciated, requires its own compositions. This grand piano was demonstrated at the recent German Radio Exhibition, when the electrical part was employed as a background.

The output circuit of the oscillator includes a magnetic coil similar to a loud-speaker unit, and an identical coil is fitted in the input circuit of the main amplifier. As the coupling between these two coils is tightened, more energy is transferred to the main amplifier and thus into the loud speaker; in other words, the volume is controlled by variation of the coil coupling.

The "Trautonium" constructed by Dr. Trautwein of the

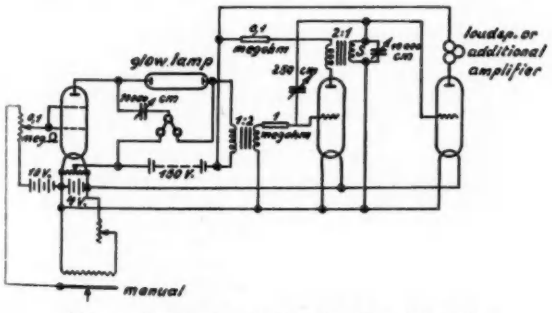


Fig. 3.—Circuit of a single-note "Trautonium"

A Tram Shed Converted for Trolley-buses

THE South Lancashire Tramways, Ltd., has discontinued the last of its tram services which served a large area in South Lancashire with individual routes up to twenty miles long. Mr. E. H. Edwardes, managing director and chief engineer of the concern, had several years ago adopted a policy of gradual progression towards the employment of electric buses; no new track was laid, or trams bought, whilst only running repairs were done to the track. Petrol buses on many of the newer routes reinforced the dwindling tram service, and meanwhile depôts were altered to house trolley-buses. This article describes the means whereby a shed built for housing and repairing tramcars was altered to suit the new buses.

The depôt at Atherton comprised three long and comparatively narrow bays; the garage bay held three tracks for storage, and the other two had two tracks in each for washing, painting, electrical maintenance and major repair work. Each road had an inspection pit running its full length, and, except in the repair bays where the pits have been covered to the level of the surrounding floor by continuous reinforced concrete arches, the depôt will be used in much the same way as before. The repair bays contain short pits and lifting jacks and overhead cranes.

The machine and electrical shops are an annexe to the main building, but the armature shop is partitioned off inside one bay, an arrangement that had a considerable bearing on what was done. The existing entrance at the western end is level with the road, but there is a three-foot rise in the length of the shop, and adjoining property so closely approaches the end wall that a large portion of this would require to be demolished to provide reasonable exit at this end. The use of a turntable to meet these difficulties entailed the keeping free of valuable space for manœuvring and the use of a complicated overhead conductor system. A turntable in combination with a traverser would give the shops maximum capacity and maintain the longest horizontal axis of the bus in an east and west direction.

The turntable and traverser

Methods of Handling the Vehicles

Messrs. S. H. Heywood & Co., Ltd., put forward a design suitable for buses 30 ft. long overall, and up to nine tons in weight, and electrically operated on both motions from a 550-V d.c. traction supply. The traverser is of the sunk type running on bulb-head rails, the level of which is 3 ft. below the ground; the rails are carried on wood sleepers to ensure silent running, and the remainder of the pit is surfaced with concrete, to permit draining of water from the buses into a sump. Bare conductors supplying current for its operation are carried from the stanchions built into the end wall, and these also take the strain of the conductors supplying the bus.

The traverser mechanism consists of a main frame composed of rolled steel sections braced and plated and carried on four large diameter cast-steel runners. These are bushed and revolve on easily removable fixed steel axles, two runners being geared and driven, through a cross shaft and two reductions of steel spur gears, by a 20-h.p. electric motor arranged to move the table at a full load speed of 300 ft. per min. Lest the impact of a bus coming on should move the table, a solenoid operated brake of the calliper type acts on a drum keyed on the motor shaft. It is applied by means of a weight and released electrically. It may also be applied by means of a pedal in the driver's enclosure connected to it by wire rope. Since the longest buses overhang the turntable, the motor and gearing have been accommodated on one corner of the framework, the driver's enclosure occupying the other corner.

In order that the traverser shall discharge vehicles into the bay farthest from the road, it has to approach close to the wall of the armature shop so that all turning must be done before the traverser comes opposite this road. This is the only position from which the traverser must be moved before rotating a bus, but it has prevented the employment of a full-circle supporting track for the turntable which is connected to the main frame by a king-pin keyed to a crosshead, the trunnion ends of which fit in the table. No drive is taken through this fulcrum. The subframe carries a steel casting in which the lower end of the king pin is free to revolve in a roller journal. The casting has a spherical seating on its upper surface and a bronze washer attached to the table rests in this; thus the table can rock about its centre without deflecting or putting appreciable bending moment on the king-pin. Three rollers are carried by each curved end of the turntable, and these engage between the flanges of a curved channel track which extends through approximately 210 deg. of the full circle. Ramps on the open ends of the track assist the rollers to engage correctly. When the bus moves on or off the table the latter is supported at its centre and either end, but half the length is cantilevered during 150 deg. of a half-turn. A large diameter spur wheel is bolted to the underside of the frame and is driven by a 5-h.p. motor through worm gear.

The motors and drum-type controllers are of the Metropolitan-Vickers Electrical Company's make. The resistance is Heywood's cabinet type of two-minute rating, and protection is provided by a switch and fuse panel. Wiring is carried out in C.M.A. cable run in continuous screwed tubing, with the exception of the cage where Heywood patent cast-iron wiring troughs are employed. The turntable itself is decked in pitch pine to resist water or oil drippings, but the tyre ways are of 18-in. chequer plate, sunk slightly below the decking.

Electrical Musical Instruments (*continued from the previous page*)

High School of Music, Berlin, cannot be compared with the piano. Impulse vibrations of a neon-lamp are employed. They are varied in fundamental frequency by means of a resistance. At the same time, these vibrations touch a circuit in which determined frequencies can be obtained by means of a variable condenser. Thus, the basic notes are caused by the voltage shock vibrations of a neon lamp, and the "formants" through a succeeding coupled circuit, the fundamental notes being correspondingly adjustable by a resistance and the "formants" through the settings of a variable condenser. This instrument was first shown at the last German radio exhibition, and it proved the possibility of imitating the sound characteristics of any instrument, such as the oboe, bassoon, trombone, &c.

"Electrical Music"

Together with Dr. Trautwein, the Russian Theremin, whose ether-wave instrument is well known, claims to have invented "electrical music." Dr. Trautwein's first patent is about six months older than Theremin's main patent.

The Theremin instrument is based on the principle of the jamming of two radio transmitters. One of the sets of plates of the oscillation circuit condenser is connected to a rod attached externally. Through the approximation of the player's hand (capacity) to the rod, the tuning of the transmitter is so changed that a differential note is produced between this and the other transmitter. The apparatus is easily constructed for connection to any type of valve receiver and by the movement of the hand from the body toward the rod the entire audible range of frequencies is passed through.

Recently, volume control has been effected with the aid of a pedal coupled to a potentiometer. The presence of notes of sinusoidal frequencies and their high harmonics, at certain settings of the tuning, is a disadvantage of the Theremin apparatus. Also, this kind of music has a tiring effect, after a short time. The hand must, therefore, not be allowed to remain in one position, but must vibrate continually, causing a violin-like tone. Consequently, the method of playing is very difficult.

Electricity in Hairdressing

THE water-heating installation at the new hairdressing establishment in Fenchurch Street, London, of Messrs. Austin Reed, Ltd., is an excellent illustration of the unequalled service which the electrical industry can offer the hairdresser in the way of hot water and towel steaming and drying; of the fairly extensive field for development for the load builder; and it shows how electrical equipment can be connected on both the electrical and water sides to afford economical working.

Serving two rows of four basins each in the saloon there are two 20-gal. "Genii" automatic pressure-type water heaters supplied by Messrs. George Nobbs, Ltd. Each heater is equipped with a 2-kW base-heating immersion unit near the bottom of the tank and a similar unit for booster heating at about a third of the height of the cylinder from the top. In conjunction with each heater there is a thermostat. The copper containers and the rust-proofed steel outer casings of the heaters are separated by 3 in. of cork heat insulation, and the exterior finish is white enamel. An internal conduit tube in the lagging communicating with the lower and upper terminal boxes eliminates the necessity for more than one external electrical connection to each heater.

These water heaters are situated in a room adjacent to the actual hairdressing saloon, and on the water side they are interconnected with cocks on both sides in such a manner that either heater can be used to serve its own or both rows of basins so that either or both heaters may be in service at any time, according to the hot water demand, or one heater may be opened out for inspection or cleaning without shutting down the whole hot-water system.

Normally both heaters are in circuit serving jointly both rows of basins. They are supplied from an external cold-water ball-valve cistern and equipped with expansion air vent pipes, the hot water being delivered at each basin through the usual hairdresser's shampoo-mixing valve.

For the supply of steamed and dry towels there are situated centrally in the saloon proper two double-unit wet- and dry-oven equipments. Each section of these consists of, from top to bottom, a steaming oven, a drying oven, a clean-towel cabinet, and a soiled-towel compartment. The two sections are arranged in back-to-back fashion with common steam and water jacketing under and around the ovens, the bottom portions of the drying ovens being immersed in the water to a depth of about 8 in.

There is normally about 10 gal. of water in each equipment. The bottom of each top oven is perforated for the admission of steam. Under each oven there is a 1,500-W immersion heater, and the two are controlled by a thermostat situated between the backs of the two ovens. The probable day working temperature of the water is 190 deg. F., and the proposal is to reset the thermostats each evening at about 105 deg. F., at which temperature the staff will find the water on arrival in the morning when readjustment to 190 deg. F. will result in hot water and "steam" being available very quickly.

Mr. Dexter, of the Dexter Manufacturing Co., which produced these steaming and drying outfits and were the main contractors for the saloon equipment, told us that he is inclined to the view that more satisfactory working would probably result from a lower day setting (about 130 deg. F.).

Each equipment measures 6 ft. high, 2 ft. 6 in. wide, and 18 in. deep. They are fed from a ball-valve cistern. Included in the other appliances, &c., which all help to make the saloon truly all-electric, are a sterilising cabinet for hairbrushes and combs (Bacterole, Ltd.); small sterilisers shaped like coffee pots for shaving brushes and razors; a small air-compressor plant which serves "guns" at the chairs; a B.T.-H. refrigerator for the supply of ice packs; tubular heaters under the basins and an inset fire; a hair dryer; high-frequency apparatus; a vibrator and a small ultra-violet light lamp. The lighting is very pleasing and is supplied from rectangular, suspended units. The wiring contractors for the installation were Messrs. Tyler & Freeman.

A Modern Hairdressing Establishment

1. A general view of Messrs. Austin Reed's saloon. 2. One of the "Genii" calorifiers. 3. Sterilising equipment. 4. Showing the tubular heating system

The Central England Grid Tariff

Trading to commence in the sixth area in April

THE Central Electricity Board has notified authorised undertakers in the Central England Area that trading operations under a grid tariff will commence on April 1st instead of at the beginning of the year, as has been customary hitherto.

Otherwise the new tariff itself is substantially similar to those already framed for other areas. It comprises (*a*) a service charge for more than one point of supply; (*b*) a fixed charge of £3 10s. per kW of maximum demand made during the four winter months, with a reduction of 5s. in respect of each "standard increment" of m.d. down to £2 15s. for each point of supply, subject to an increase of 4s. 6d. for each 0.1 by which the power factor falls below 0.85 lagging during the half-hour in which the m.d. is registered and to the usual adjustment for municipal rating valuation of selected stations; (*c*) a running charge of 0.196d. per kWh supplied (based on existing prices in the area) subject to a variation of 0.001d. for each penny by which the cost of coal is more or less than 12s. per ton. Special prices may be negotiated in exceptional circumstances.

Standardisation of supply in this area has not yet been completed; the conversion of frequency involves some 550,000 h.p. of motors and nearly 340,000 kW of generating plant. But sufficient generating stations have been operating in parallel for the past three months to justify the adoption of the new tariff.

Twenty stations have been selected for permanent operation, including the new one erected at Ironbridge by the West Midlands Joint Electricity Authority. The other principal selected stations are Hams Hall (Birmingham Corporation), Spondon (Derbyshire and Nottingham Electric Power Co.), Freemans Meadow (Leicester Corporation), North Wilford (Nottingham Corporation), and Stourport (S.W. & S. Electric Power Co.).

Interconnecting the stations are 397 miles of primary, and thirty-two miles of secondary, transmission lines, including an additional secondary line fourteen miles in length which has just been erected between Northampton and Kettering in connection with the provision of supplies through the grid for the steelworks now under construction for Messrs. Stewarts and Lloyds at Corby. This extension represents an interesting development of the grid beyond the scheme as it was originally planned. The Central England system is linked up in the north with the North-West England and North Wales area scheme, in the south with South-West England and South Wales, and in the east with South-East England. The output of authorised undertakings in the area last year was nearly 2,000,000,000 kWh, representing an increase of about 111 per cent. over the figure for 1926.

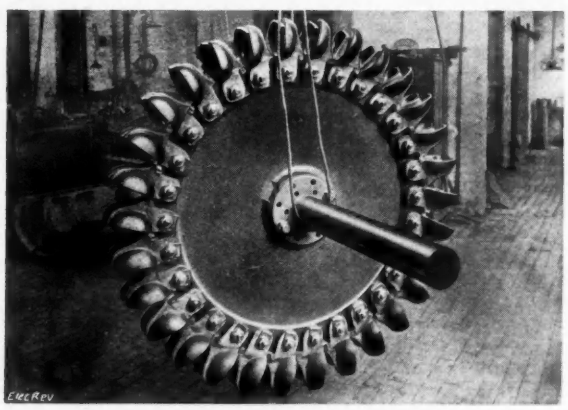
The Central England area of 7,311 sq. miles extends from Stoke-on-Trent and Mansfield in the north, to Tewkesbury and Buckingham in the south, and from Newark in the east to the Welsh border. It has a population of over five and a half million, and large manufacturing centres representing a wide diversity of industries.

With the introduction of a grid tariff for Central England the Central Electricity Board will be trading in six out of the nine areas in which regional schemes have been developed to form the national system. These six areas aggregate 41,185 sq. miles, and contain a total population of nearly thirty-five million, or 77.5 per cent. of the population of the whole country. Grid tariffs have been in operation in Central Scotland and Mid-East England since January 1st, 1933, and in North-West England and North Wales, South-East England and East England since January 1st this year. The three remaining areas for which tariffs have still to be arranged are South Scotland, which is largely rural and in which water-power is being developed; South-West England and South Wales, for which a tariff is to be framed next; and North-East England, where frequency standardisation is proceeding.

A Hydraulic Turbine for Gas-charged Water

AN interesting hydro-electric set for the recovery of power from water under pressure has been manufactured by the English Electric Co., Ltd., to the order of the I.C.I. (Fertilizer & Synthetic Products), Ltd., and is now operating successfully at a chemical works in South Africa.

Some 477 gal. of water per minute is discharged from the chemical manufacturing process under a head of 1,700 to



The turbine runner has buckets of mild steel which is resistant to the gas-charged water

1,870 ft. and it contains from 6 to 10 times its own volume of gas in solution. The problem was to construct a turbine capable of extracting the energy and discharging the mixture of gas and fluid to a height of 67 ft.

While the high head makes the use of an impulse type of turbine imperative, an obvious difficulty is that as the water passes out of the nozzle its pressure will drop; the gas therefore must be liberated in large quantities and in so doing will break up the jet into spray and prevent useful work being done on the buckets of the runner wheel. A properly shaped nozzle and buckets have, however, enabled the pressure energy of the water to be converted into the velocity energy of the jet and then into mechanical power so rapidly that the gas has no time to come out of solution and become harmful.

The condition that the water must be exhausted under sufficient pressure to recover subsequently to a head of 67 ft. has been satisfied by so placing the inlet and discharge pipes and so designing the casing that the latter will always be filled completely with the gas liberated by the water on its way through the turbine. Thus this cushion of gas forces out the fluid discharged by the wheel.

The impulse turbine runs at a speed of 1,000 r.p.m. and is overhung on an extension of the generator shaft, the whole set being mounted on a combined bedplate of cast iron, with only two bearings and one common shaft. A flameproof slip-ring arrangement being essential on account of the nature of the chemical work, the alternator slip-rings had to be totally enclosed. This necessitated a whittle-belt-driven exciter, which is mounted on the combined bedplate.

The large cast-steel casing is split horizontally to provide easy access to the runner. Windage losses are reduced by adopting a narrow cover. The sub-division, the flat sides, and the internal pressure made massive construction essential, since with the chemical process involved the back pressure might fluctuate and consequently a high factor of safety was indispensable. Accordingly, a test pressure of 70 lb. per sq. in. was successfully withstood, and as a further safeguard an emergency bursting plate with exhaust pipe is connected to the top of the cover.

The Turbine Runner

The runner has buckets of mild steel alloy, which is resistant to the gas-charged water. To secure perfectly homogeneous material the buckets were stamped instead of being cast. They have accurately shaped splitter edges for dividing the jet without shock, and highly polished hydraulic surfaces to minimise friction losses and prevent wear. Each bucket is fixed to the mild steel disc by a single, slightly coned bolt enclosed in an expanding split bush, alternate buckets bearing on shoulders integral with the disc and on driven-in taper keys.

Where the shaft passes through the water-cooled pressure gland of the turbine casing it is sleeved with stainless steel and the axial force is taken up by a ball thrust.

The streamlined inlet bend feeding the turbine has a nozzle controlled by a hand-operated spear, both of stainless steel suitably polished. A ring of axial guide vanes rectifies the flow in the nozzle, so that a good jet may be formed, and also guides the spear.

As the discharge remains practically constant and there is no change of load a governor is not required. An overspeed trip to guard against runaway in an emergency is, however, provided.

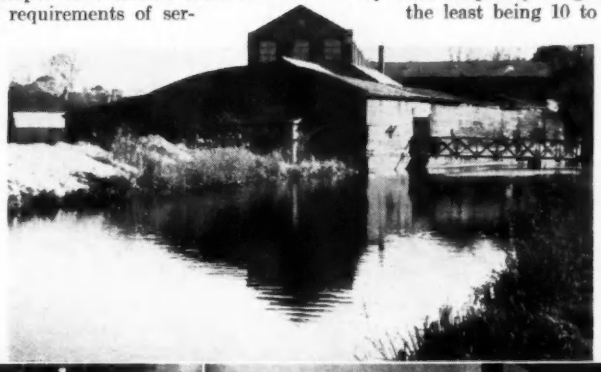
MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Radio Reception in Naval Ships

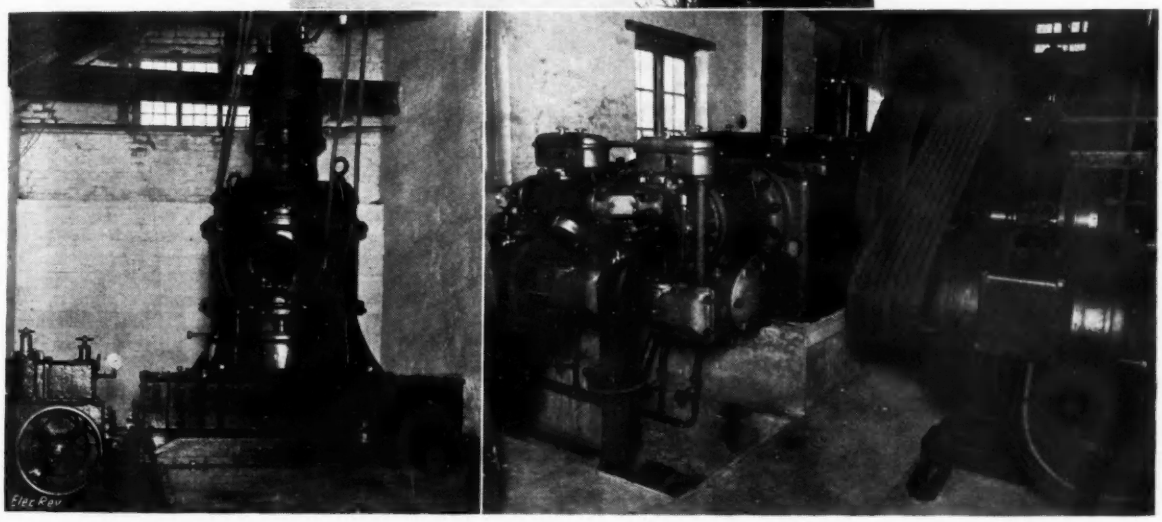
THE main object of the paper by Dr. W. F. Rawlinson which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 7th was to discuss the particular difficulties encountered in the reception of radio signals in Naval ships, and to refer to apparatus which has been developed to overcome these difficulties and fulfil the stringent requirements of service under seagoing conditions.

The choice of aerial is very limited; it terminates in a deck insulator and junction box, from which a paper- and air-insulated cable is run to the receiver. This cable combination has a large influence on the design of the input circuits and on the signal strength obtainable, and has to be made with special characteristics.



Three types of valve were adopted in an attempt to ensure a steady supply without having to resort to special manufacture, but this hope has not been fulfilled. It is obviously impossible to scrap receivers every few years or even to modify them, and it is equally impossible to design receivers so that they can be used with valves of entirely different characteristics. Even with present valve specifications such wide tolerances must be given as to make repetition performance of receivers difficult. Apart from this difficulty in maintaining supplies, the standardisation of only a few types sets a limit to the circuits which can be used.

Very wide frequency ranges are covered by each receiver, the least being 10 to 1 and the greatest 30 to 1 for normal models, while for one particular receiver it is 1,333 to 1. Such wide ranges give rise to many serious difficulties. One of the fundamental points in all designs is selectivity. There appears to be no definition of this term which will cover all cases. Moreover, many of the definitions which have been framed relate to the separation of stations working on neighbouring telephony channels and of comparable field strength. For the reception of Morse signals such matters as side-band cutting, tone correction, or fidelity of reproduction are of very minor importance, and the so-called highly selective receiver, embodying a single tuned circuit of very low decrement does not prove in practice to be the receiver of greatest selectivity.



Hydro-electric and Diesel plant at the Downton Mill, Wilts. (See page 359)

Above, the mill; left, the 85-kW Armfield-Brush water turbo-alternator; right, the new Brush Diesel generating set

A Direct-reading Form Factor Meter

MOST of the defects of the two methods at present in use of determining the form factors of alternating voltage or current waves of varying shapes can be avoided by employing a low-range dynamometer voltmeter connected in parallel with a permanent-magnet moving-coil voltmeter with a copper-oxide rectifier arranged to work at a constant r.m.s. voltage, means being provided to vary the voltage applied to the combination until the dynamometer indicates some standard value. When this adjustment has been made the indication of the rectifier instrument will depend only upon the form factor of the applied voltage, and the instrument can be scaled to show this quantity directly.

A combination of this kind, designed at the National Physical Laboratory in co-operation with the Cambridge Instrument Co., Ltd., is described in the paper by Mr. R. S. J. Spilsbury which was read before the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 2nd.

In its present form this meter is of high accuracy and is substantially free from errors due to normal variations of voltage, frequency, temperature and wave-shape, except in the cases of re-entrant waves and rectangular waves of a particular type, the effects of which are discussed in an appendix to the paper. The meter is applicable to voltages between 20 and 272 V by adjustment of the turning heads, and lower voltages are aimed at.

Copper-oxide Rectifiers in Ammeters and Voltmeters

A MOVING-COIL meter in conjunction with a copper-oxide rectifier possesses far greater sensitivity than any other arrangement for measuring very small alternating voltages and currents. As this combination is therefore likely to be used very extensively in future the errors that may arise have been investigated and methods of reducing them are suggested in the paper by Dr. E. Hughes which was read before the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 2nd. The general conclusions arrived at by the author are that the introduction of a rectifier into a circuit of comparatively low resistance distorts the current wave and causes a rectifier ammeter calibrated with a sine wave to read low. The lower the resistance the greater is the error; and, for a given resistance, the smaller the current the greater, in general, is the error. Owing to its lower resistance, a 10-mA rectifier is generally much more

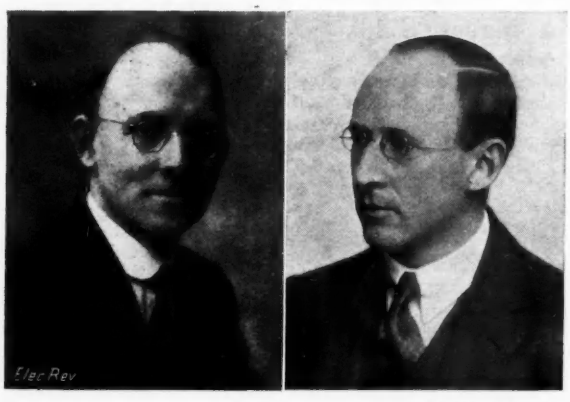
suitable than a 1-mA unit for measuring currents of the order of microamperes.

Inductive reactance reduces the distortion of the current and thus reduces the error in a rectifier ammeter calibrated with sinusoidal current. Capacitive reactance, on the other hand, has the opposite effect. The value of the effective resistance of a rectifier is affected by the amount of resistance in series, being lower the smaller the resistance in series. The relationship between the rectified current and the voltage applied to a rectifier voltmeter depends upon the value of the series resistance. With comparatively low values of the latter the exponent of the voltage is approximately 2, and the instrument reads roughly the effective value of the alternating voltage independently of wave-form.

When a rectifier instrument having a linear characteristic is used with a very badly distorted wave, such as that produced by telephone currents, its reading is generally much nearer the true effective value than that given by an instrument dependent upon the true mean value of the current. Except for a certain range and phase of the third harmonic, a rectifier instrument calibrated with a sine wave reads the effective value within 10 per cent. for any shape of wave however much it may be distorted.

When a rectifier instrument is used in conjunction with a current transformer, the ratio of primary to secondary current may be rendered practically independent of the current, frequency, and wave-form, either (*a*) by giving the secondary winding a very large self-inductance, or (*b*) by connecting a low resistance across the secondary terminals of a commercial current-transformer and using the rectifier instrument as a low-reading voltmeter to measure the potential difference across that resistance.

If the rectifier be connected in series with a comparatively high resistance across a secondary of relatively low reactance, the rectified current is proportional to the frequency and is greatly affected by harmonics in the primary current; and the higher the frequency of the harmonic the greater is the error.



[*Elliott & Fry*

The authors of the papers read at the I.E.E. last Friday. Dr. E. Hughes (left) is head of the Electrical Engineering Department of the Technical College, Brighton; and Mr. R. S. J. Spilsbury is a member of the staff of the electricity department of the N.P.L.

The Measurement of Engineering Noises

A DETAILED investigation of noise measurement, which was undertaken for the purpose of establishing methods generally applicable to the sustained noises encountered in engineering, is described in the paper by Messrs. B. G. Churcher, A. J. King, and H. Davies which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 8th.

The necessity for redetermining the properties of the hearing system of the average individual in terms of free-space conditions of listening is explained, and the results obtained on fifty persons are given. The inadequacy of the logarithmic decibel scale for indicating subjective loudness is discussed and two alternatives are considered, namely, integrated and multiple loudness scales. The last mentioned method of mental estimation is suggested as being the more helpful in conveying numerically the desired impression of the degree of noise loudness.

Desirable improvements in the noise-analysing apparatus described in the previous paper (I.E.E. *Journal*, 1930), are indicated, and new equipment embodying these features is briefly described. The various methods of assessing the loudness of a complex noise are considered in relation to engineering requirements, and the reasons are given for the choice of the aural balance method using a pure reference tone with a frequency of 800 cycles per sec. Experience obtained with this method in assessing typical noises is described. Finally, consideration is given to the problem of specifying the noise which a piece of apparatus may make when installed in a particular location.

Magnetism, Valve Filaments, Ionisation and Electrical Prospecting

AMONG the several papers submitted at the March 2nd meeting of the PHYSICAL SOCIETY in London was one in which Prof. A. O. Rankine describes an attempt to construct a magnetic gradiometer capable of measuring small distortions of the earth's magnetic field in the same way as the Eötvös torsion balance measures non-uniformities of gravity. Although this purpose has not yet been achieved, the instrument has revealed itself as a means of demonstrating in a convincing manner the paramagnetism or diamagnetism of substances of small susceptibility; for example, the diamagnetism of a few cubic centimetres of water. Moreover, the magnetising fields employed are much smaller than have hitherto been customary, being of the order of 50 gauss or less, and it seems certain that gases also can be brought within the scope of accurate determination, while the system used provides a possible basis for the construction of a promising new form of very sensitive galvanometer.

Anomalous changes in temperature due to thermionic emission in the filaments of valves are dealt with in a paper by Mr. A. M. Ferasah, who shows that in some valves the steady filament temperature is lower when the anode is positive, as would be expected, but in other valves it is higher, due to radiation from the anode; it is larger for valves which have a high anode dissipation and an anode which closely surrounds the filament.

Dr. Mary Taylor presented curves calculated by the Appleton-Hartree formula to illustrate the effect of collisional friction on the indices of refraction and attenuation for the propagation of electromagnetic waves through an ionised medium in the presence of an external magnetic field. The attenuation and absorption are, in general, greater for the right-handed component than for the left-handed component, with the direction of magnetic field appropriate for down-coming waves in the northern hemisphere. Consideration of the values of the indices of attenuation in addition to those of the indices of refraction leads to the general conclusion that the lower boundary of the Kennelly-Heaviside layer must be sharp in the optical sense and that reflection of long waves occurs at this boundary at the same height, in general, as that of much shorter waves.

An instrument for electrical prospecting by the inductive method is described in a paper by Mr. J. McGarva Bruckshaw, who examines the conditions in the Bieler-Watson method of geophysical surveying, and demonstrates that, in general, the horizontal field is not in quadrature with the vertical field. An instrument has been designed which will allow the horizontal field to be compared completely with the vertical field, the important feature being that the horizontal components in phase and in quadrature with the vertical field are obtained directly from the instrument readings. The apparatus has been tested on elliptically polarised fields and has given satisfactory results.

Industrial Switchgear Design

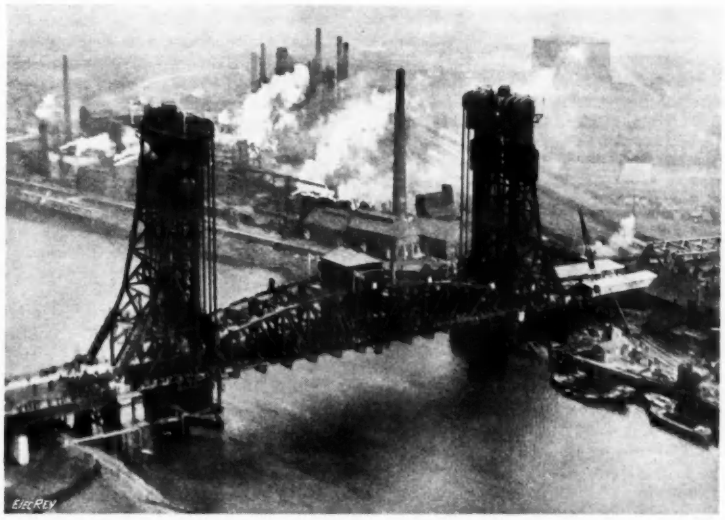
IN a paper by Mr. J. O. Knowles on modern switchgear for industrial distribution and motor control, which was read before the BELFAST ASSOCIATION OF ENGINEERS on February 28th, reference is made to the many varieties of plug and socket contacts which have been developed, both for use where circuit is not normally broken, as on isolators (including truck and cubicle isolating plugs), and on fuses. The plug contact, being round, has more mass of metal adjacent to the contact surface than a blade or wedge. The arcing tip of a round plug may, therefore, be cooler and less damaged by arcing than the thinner end of a wedge or blade. It is, of course, essential with a solid unbending plug to make some provision for accurate alignment or self-alignment of the socket, which may be split in various ways.

There is a welcome tendency to use higher voltages in industrial work in place of large currents. For dealing with individual circuits carrying over 1,000 A at 400 V, the equivalent switchgear (to carry the same power) at 6,600 V would be cheaper, the cables perhaps a quarter the price, and the transformer costs reduced or removed. Motors down to 50 h.p. are now frequently connected at an intermediate voltage of 3,300 V.

There is an increasing use of fuses, and tentative figures are given in the paper for short-circuit ratings for a.c. fuses, the

author suggesting that a given size will interrupt from three to five times as much a.c. as d.c. Where smaller cables branch from a larger one a fuseboard is more compact and far cheaper than a circuit-breaker distribution board, while a fuse is much quicker in action on a severe short circuit.

It takes from 0.1 to 0.2 second for a circuit-breaker to open, whereas a 500 A cartridge fuse will take about 0.02 second and a 30-A cartridge fuse about 0.001 second. Remembering that alternating currents are of wave form rising from zero to maximum in 0.005 second, it is clear that a 30-A cartridge fuse blows so quickly on a heavy short-circuit (of say 50,000 A) that the current has not time to rise even once to its possible maximum, the supply being interrupted before the current exceeds 3,000 A. A circuit-breaker, on the other hand, opening even in its minimum of 0.1 second, would allow the current to rise to its possible maximum eight or ten times before the circuit was interrupted. As instances of what can happen in 0.2 second, the author mentions that a short-circuit of only 5,000 kVA burst a flexible cable designed to carry 80 A in this time and that a short-circuit of 15,000 kVA lasting for 0.2 second burnt entirely through a copper bar 1 in. by ¼ in. in section.



This electrically operated vertical lift bridge spanning the Tees at Middlesbrough was opened by the Duke of York last week. The contractors were Dorman, Long & Co., Ltd., and electrical plant was supplied by Thomas Broadbent & Sons, Ltd.

In drives of large horse-power there has been an increasing tendency to use a constant speed motor with a hydraulic coupling, giving a speed variation controlled by varying the flow of oil in the coupling. For the control of power-station boiler-house fans this method is in the forefront of modern practice, instead of the older methods of two-speed motor control, wound rotor resistance control, and d.c. control.

Apart from the control of speed, the control of a.c. motors tends to become simpler. Within the power station itself, large motors up to 250 h.p. are sometimes now designed to be started by throwing them direct on the line, though the starting currents may be as high as eight times full load current or up to 2,500 A. Remote control is simplified by the reduction in the complication of the switchgear. The largest installation outside a power station where straight-on starting has been used, in the author's recent experience, consists of four 180-h.p. pump motors thrown directly across a 3,300-V three-phase supply. The full load current of each motor at this voltage is only approximately 30 A and the design of motor is such that without sacrifice of efficiency the starting current does not exceed 90 A or three times full load. The motors are driving mine pumps and will be rarely started or stopped. For small motors the method of direct starting has become standard. The contactor type of switch has also been found excellent and economical for this service.

There has been a noticeable change in thought regarding motor control gear; convenience in operation has become a much more practical consideration, for the operator must watch his work and not the electrical controls. It has sometimes been argued that the tendency to use straight-on starters and other simple forms of control gear will reduce the volume of business in motor control switchgear. The author, on the other hand, welcomes the simplification of automatic control gear. With the increasing use of electric drive, the mechanical engineer appreciates more than previously that an electrical control may be simpler and cheaper than a purely mechanical device. Closer co-operation between mechanical and electrical engineers in designing any plant arranged for human control will be a feature of many designs in future.

The Wiring of Large Buildings

A CROWDED attendance was attracted to the informal meeting of the Institution of Electrical Engineers on February 26th to hear Mr. A. F. W. Richards open a discussion on the design of wiring installations in large office buildings. He covered a great deal of ground and used numerous lantern slides to illustrate the layout of the feeders, wiring, switchgear, &c., of a number of outstanding modern buildings.

In this country, he said, it had not been found necessary to take high-voltage feeders to the upper floors of office buildings, but it was frequently rendered necessary in America by the great height of the buildings there and the lower distribution voltages common in that country.

Standby supply was sometimes provided by a battery, which fed emergency lighting circuits and a few of the office machines, so that essential services could be kept in operation in the event of a main supply failure. Often the main service was divided between two supply authorities, with a change-over switch to throw the whole load on to one source in case of failure of the other. Even this did not satisfy the requirements of the L.C.C. licensing authorities, and batteries had been installed in the basements for dancing and concert halls.

Generally, distribution in most modern buildings was on the three-phase four-wire system; the economy in copper which resulted from the use of this system was perhaps not always thoroughly appreciated. By balancing floor against floor, and having only one phase on each floor, it was practically impossible for anyone to obtain a 400-V shock. Many buildings, however, were balanced wing by wing, or section by section, and though no doubt this was perfectly satisfactory when the installation was first designed, there was always a risk of overlapping in future and the possibility of getting two points in the same room on opposite phases.

The "Riserod" System

Various types of rising mains were described, including bare rod or strip supported on insulators, insulated rod, v.i.r. insulated cables and cables insulated with paper or other fibrous material. A noteworthy case of the bare strip system was that installed at the Prudential Building at the end of the 'nineties. Much of this strip was still in use after this lengthy service. The insulated "riser" rod system was in use at the Leeds and Southampton Civic Centres, and was at present being installed in the Manchester Reference Library. It consisted of solid copper rods or tubes insulated with a close fitting sleeve of micanite 1 mm. thick. These riser rods had the same advantage of being capable of withstanding much higher temperatures than cables insulated with v.i.r. or paper, and it was easy to increase the capacity by using larger rods.

The great majority of large blocks of office buildings were wired on the heavy gauge screwed conduit system, the conduit being usually enamelled, though in some cases it was galvanised. Copper tubing had been used in a few cases, such as at the Bank of England and South Africa House. Condensation troubles were minimised and though the cost of material was undoubtedly considerably higher, it was claimed that this was offset by the ease of setting and cutting the tubing, and that the net result was that on the whole installation the overall cost was only increased by 10 per cent.

For installations at a bank in Liverpool and in new railway offices in London, the ducts were formed in semi-circular section of a fibrous material which was impervious to moisture. This was laid on a sheet of bituminous asbestos on the floor before filling in with concrete. Joints were sealed by hot bitumen to ensure protection against moisture. Junctions were taken off from inspection boxes with crossover features. Connections to isolated plugs and tubing could be made at any time by cutting through the floor covering and screwing an outlet into the fibre duct.

Some of the contributions to the discussion dealt with the difficulty of providing a building in the carcase state with the switching and the floor outlet demands of the subsequent tenants. The adaptable and ingenious conduit fittings illustrated by Mr. Richards appeared to cope with most of the troubles arising from alterations and extensions, though the need for more generous allowance of space by architects was repeatedly referred to.

Mr. R. Grierson spoke of the tendency to multiply protective gear and of the growth of apparatus in the switch-room, often very inadequately spaced. Most trouble was due to circuit-breakers operating, and it was desirable to eliminate all but absolutely essential switching and fuses. Further, one should aim at reducing all ignitable material, such as paper, cambric, and resin insulating materials, and to replace it by bare rod and strip for the large main services. Mr. E. E. Hutchings said that a closed vertical chase in large buildings often created high convection currents, affecting the heating of the cables it contained.

One remedy for this was to extend the chase some five or six feet above the rising main. With regard to strip or rod mains, investigations into the flow of heat where cables were teed-off from the rod showed that it was desirable to remove the rubber for a considerable distance up the cables.

Aspects of the London Passenger Transport Problem

IN an address delivered to the LONDON SCHOOL OF ECONOMICS on March 5th, Lord Ashfield confessed that the establishment of the London Passenger Transport Board, which aimed at a definite and consistent policy of unification, had made little change in the situation so far. He affirmed, however, that radical changes would come about, but they would be slow and not revolutionary.

One aspect which escaped attention was the large part of the provision of services in London transport which was conducted on an unremunerative basis. While the Board had to make liberal provision for services, the resources at its disposal for development and expansion were slender. Only as the existing services attracted their full traffic and became remunerative would the Board be able to venture on fresh ones, unless these new departures were actually self-supporting.

The stability of the Board, and its financial integrity, depended upon a right appreciation of balance of obligations and resources year by year. This seemed to require the attention of a juggler rather than of the ordinary sober business man.

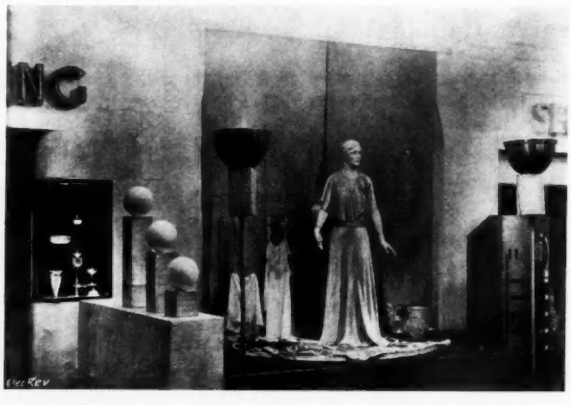
Therefore, the Board was necessarily driven to proceed cautiously and slowly with any measure of economy and development, and to look not so much to the reduction of its services as to the redistribution of them in a manner which would be more effective.

Canvassing for Consumers. By A. V. Cross

I HAVE sometimes thought of compiling an index classifying the types of householders that we meet when canvassing for electricity consumers, but the task is a difficult one, and would probably become a psychological treatise instead of a guide as to the methods of approach. It should be possible, however, for psychology and methods of approach are very closely allied.

There is no reason why the canvasser-representative for electricity supply should adopt methods different from those of, say, a canvasser for pianos or milk. The potential consumer of electricity is no more interested in the grid and load factor than the milk consumer is in the Milk Marketing Board and minimum price levels. Let us proceed then briefly to study types of householders.

First there is the spirit of jealousy and competition between neighbours to be reckoned with; it may help or it may hinder. When the Supply Department proposes to lay mains in a street having many houses the canvasser is greatly encouraged if he secures applications from the first places of call. He has a "selling point" of value when making other calls. When imparting the usual brief details, advantage should be taken



A shop-window lighting display recently staged at the Lighting Service Bureau, London

of the opportunity of getting home the news that Mrs. So-and-So at such-and-such a house is having electricity installed. The usual reply is that the husband will be informed, and a request is made that the canvasser shall call again, but sometimes the lady of the house decides for herself on the spot, determined not to be outclassed by a neighbour. On his return home the husband is awakened to electrical consciousness, and with meek resistance signs the application forms, &c., if his wife has not already done even that "on her own."

Sometimes one hears of a "strong" woman or man amongst the tenants. Such should be hunted out at an early stage and won over so that others may follow like sheep.

Another type is the householder who "works things out." People of this class go into endless details, have wonderful flights of imagination, and speak glibly of the "all-electric" home—but they come to earth rapidly. Though they appear to be so completely convinced that electricity is the right thing, they fail to adopt it and give no explanation for their attitude; put it down to their being poor but proud.

Next there is the man who "if he had the money," well—there is no end to what he would do if only he had the money! But he hasn't got it, or at least not sufficient, so we must leave him and come to the man who thinks "it should be put in for nothing." He has the idea that if wiring can be installed under an assisted wiring scheme on payment of, say, ten shillings only, balance through the meter, it can be done for nothing.

The electricity supply industry is in such a healthy condition financially to-day partly because it has been built up on a sound basis; prior to the advent of assisted wiring many people who could afford to pay for installations had electricity installed and they could accordingly pay for whatever electricity they required. Consequently, consumers were of at least the "middle class," and electricity appealed as a distinctive service. But all this is altered now. Electricity is no longer exclusive to any particular class; it is as much the servant of the poor as of the rich.

The canvasser reading these notes may imagine that selling electricity is not so easy a job as might be supposed, seeing that demand is growing all over the country. Propaganda and other activities will strengthen his hand so that he can secure quicker success.

After all, the public is convinced that milk is necessary to life, and, perhaps, the day will come when it will adopt an equally enlightened attitude towards electricity. Perhaps the country will require an Electricity Marketing Board before electricity is regarded as being as indispensable as milk.

Cafe Heating in Paris

ANYBODY who knows Paris knows the coal burners which are used to heat the terraces outside cafés. These burners were never really satisfactory for the simple reasons that the heat could not be regulated, they gave off an unpleasant odour, and they were dirty. During the past few months engineers have been turning their attention to electric heaters for these terraces, and already one or two cafés have installed them. According to all reports, the results leave nothing to be desired.

Two of these installations are illustrated opposite. In the apparatus shown in the left-hand picture a fan blows the air down over heating resistances and out through the holes, visible near the bottom of the apparatus. This hot air can be felt almost up to ten feet from the heater and at a little distance above the ground.

The other equipment is of the radiant type, the elements being equipped with reflectors and protected by bars or grilles. Some constructors have designed the heaters upon the same lines as the old coal burners, but in any case the appearance is much better because the electric heater is built in aluminium with chromium fittings. The weight of these heaters is less than 66 lb.

The right-hand illustration shows the latest type of café heater produced by Claude, Paz & Silver; this measures 18 in.×18 in.×46 in. high, and has eight 400-W elements controlled in pairs. A device in the base gives the effect of burning coal. The weight is 110 lb.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Inadequate Inspection of Installations

I was interested in your comment upon Mr. H. C. Hazel's good work in checking up the standard of work of contractors on the National Register. I am amused that the public regard any contractor on the Register as 100 per cent. perfect. I have followed the work of several of its members and I can only say that some examples are a disgrace to the trade generally, and particularly to the Register.

Earthing seems to be particularly bad. In lead-covered jobs the favourite way of earthing under switch blocks, &c., seems to be to strip the lead sheath sufficiently to get the wires out and then take a length of lead and nail it to the remaining lead on each cable. The proper earth bond is apparently a luxury. Another way is to bond the lead portion with a piece of 3/.029 bare wire twisted round each cable.

Such work is obviously shoddy, and I think the main fault lies with the foreman or the principal of the firm not checking over the work of the men with enough thoroughness. In one case I know of the principal of the firm is strict enough as regards I.E.E. Rules when he is on the job, but he neglects to look at every job and the workmen take advantage of his absence.

Until the standard of workmen is raised when not under supervision the good work of the Register cannot succeed nor can the public regard the registered contractor as 100 per cent. perfect. WIREMAN.

March 5th.

Two installations of café heaters now to be seen in Paris and the latest pattern of heater for this purpose (see opposite page)

Service!

Is it necessary for those using electric cookers to possess duplicate boiling plates, to add to the already high cost? If not, what are they to do if one breaks down?

I have a boiling plate on my cooker which is supposed to be almost indestructible, but it broke down after three months of use. I took it back to the depôt in London, and was told that it would be sent to the works at once. After eight days I received a letter stating that from these works it was being sent somewhere else for repair. A fortnight has now elapsed and I am still without the boiling plate. I do not expect to receive it for still another week or two, judging by the time I had to wait when I first bought it. Is this the way to encourage the use of electricity? GAS.

February 27th.

Self-contained Saucepans

I should be pleased to hear whether there is on the market any small self-contained electric saucepan which will boil a small quantity of water, about half to one pint in five or six minutes, as it seems to me there would be a demand for an article of this description.

People who have electric cookers still come in and ask what method we suggest for boiling one egg, and it is rather difficult to know what to tell them. On a gas stove they have been used to doing it on a small burner with a tiny aluminium saucepan which boils quickly; gas can be turned down and is a distinct advantage in this particular instance over our methods. There were on the market years ago some earthenware articles under the trade name of, I believe, "Hosgood" in which an earthenware jug had the element wound in grooves on the outside, the whole being covered with a sheet of asbestos with a metal shield. This was fairly satisfactory and was quick, but I suppose the repairs and maintenance were too heavy, as the article seems to have disappeared from the market.

There have, of course, been various appliances for steaming eggs, in which a very small quantity of water forms the resistance and is turned into steam, but these have never taken on very well with customers, who have got used to the small saucepan idea. The views of your readers on this point would be of interest. H. WILSON, A.M.I.E.E.,

Ashford, Kent, *March 5th.* *Electrical Engineer.*

Contractors and Supply Authorities

A recent article in a London evening newspaper stated that as a result of unfair competition by the local Council a contractor had been made bankrupt. I have recently lost a considerable amount of work, which has been given to a supply company which, in one case, offered attractive hire-purchase terms and secured the job.

Surely supply authorities should be content with the huge profits they make, without taking our very living? I am aware that the subject is not new, but as the menace is getting distinctly worse I would be interested to know if other contractors have had similar experiences, and, if so, do they intend taking any action in the matter. SMALL CONTRACTOR.

February 26th.

Engineers and Economics

In a letter printed in your February 16th issue, Mr. B. Wood writes: "Some of us are already convinced as to both the existence of chronic under-consumption and the reason for its existence . . . ." It is a pity to stop at that statement; will not Mr. Wood tell us more?

My firm, like all other manufacturers, wants more orders. The orders depend simply on the effective power of the community to buy the goods. They are manifestly willing enough to consume the goods, but the fact is they haven't the money.

If we can increase the purchasing power of the community in relation to the price or cost of goods industry will be saved. If we knew why this purchasing power was less than the total costs we could get our scientific minds and our engineering training to solve the problem of how to equate the two terms.

Mr. Wood knows why; he says he is convinced of the reason for its existence! When engineering as a trade and a profession depends on this single point we ought not to be kept in the dark for a moment. Will you spare Mr. Wood half a column in your next issue to tell us why?

February 26th N.R.T., A.M.I.E.E.

Overhead Lines and Birds

In your issue of January 19th a correspondent told how a brown owl had been killed by coming into contact with overhead lines. The subject has considerable practical significance, as the economic value of bird-life in relation to agriculture, horticulture and forestry is acknowledged everywhere. Furthermore, the protection of overhead cables against even slight disturbances is essential.

In years gone by the toll of wild bird life through contact with overhead lines was extremely heavy. A friend tells me that, on one occasion alone, he found no fewer than sixty feathered victims of a 6-kV overhead wire. Amongst these were birds of several species of great value to mankind, such as rooks and starlings (prime destroyers of "leatherjackets" and "wireworms"), owls and hawks (which make warfare against rodent pests), and swallows, martins and nightjars and

other insectivorous species. There were also weed-checking birds, including linnets, chaffinches and yellowhammers. Thrushes and blackbirds, both valuable destroyers of injurious molluscs, were amongst the slain.

Where a l.v. line claimed its victims by the dozen, a h.v. line accounted for wild birds by the score. Beneath one 11-kV cable over a hundred dead birds have been picked up in the course of twenty-four hours. This was during the autumnal migration, when many species of birds travel *en masse*. Large birds are often amongst the victims; some time ago the charred remains of a full-grown swan were picked up beneath a 33-kV cable, and herons, an escaped pelican, and a cormorant have to be added to the list.

In the past the loss of bird life thus caused was far greater than it is to-day. The old type of support bracket permitted a perching bird to make contact through its body between the live line and the earthed bracket. The adoption of fibre-tube bird guards was successful up to a point, but something further was required, and brackets have been introduced which prevent the smaller birds from perching and pecking at the live wire.

Sometimes birds strike the cable in the course of their flight and are killed outright from dislocation or suffer severe injuries. However, they are just as likely to collide against telegraph wires or against "wireless" cables. Wild duck, geese, wading birds of several different species, even peregrine falcons and buzzards have met with fatal accidents in this way. Even a slender cable offers considerable resistance, enough to kill any bird of medium size that may happen to dash against it. A cable having its central core surrounded by seven or eight stout strands may easily incapacitate an eagle when in full flight.

Some time ago I saw in a private museum the bodies of birds of more than eighty species (many rare) that had met their death in the manner under discussion. Some of them had been "mummified" on the spot, others were badly burned, whilst in many cases there were practically no visible evidences of injury. Avian species killed by overhead lines that have come under my personal notice include not only several of the birds already mentioned, but also that dainty little Northerner, the twite, the redbreast, the house-sparrow and the magpie.

One magpie was picked up recently beneath a cable extending over ploughed fields. On cultivated ground, magpies render useful service, devouring large numbers of injurious insects and their larvæ, and keeping an ever-watchful eye for voles, long-tailed field-mice, and other destructive pests. Jays, too, have been brought to me by persons who have picked them up near overhead lines. The vast majority of such victims were obtained in the days before the present type of bracket came into general use. C. W. Greatorex, F.Z.S.

Worksop, *February 28th*.

A New Apparent-power Meter

The use of copper-oxide rectifiers

Supply tariffs for large industrial consumers of alternating current tend more and more to be based directly on the apparent power consumption (volt-amperes), this being the factor which determines the dimensions of generators, transformers, &c., and the transmitting capacity of the lines in a distribution system.

An ordinary wattmeter, with shunt winding connected across the load voltage U and series winding carrying the load current I, is subjected to a torque proportional to UI cos ϕ, where ϕ is the angle of phase difference between I and U. With constant U and I, the wattmeter deflection is a function of ϕ as shown by fig. 1, and the instrument measures the apparent power UI accurately within ± 1 per cent. provided that cos ϕ is not less than 0.98 per cent., *i.e.*, so long as ϕ does not exceed 12 deg. lead or lag.

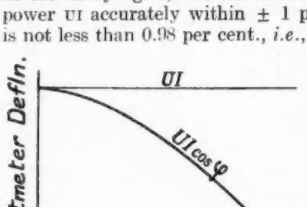


Fig. 1

By arranging that the current in the shunt winding is 30 deg. out of phase with the voltage, the maximum of the curve in fig. 1 can be displaced so that the error of the wattmeter used as a volt-ampere meter is within ± 2 per cent. over a considerable range of power factor (fig. 2), but outside these limits the error increases rapidly. In order that the instrument may measure UI accurately at all power factors, the phase displacement of the current in the shunt winding must be a function of the power factor.

This difficulty is overcome by means described by J. Piron in the *Revue Générale de l'Electricité*; the wattmeter windings are fed with continuous currents proportional respectively to the a.c. voltage and current, these currents being obtained by aid of copper oxide rectifiers. It is not sufficient merely to rectify the alternating currents in question because the resulting currents are undulating and the effect of power factor is not completely eliminated. In the case of a single-phase a.c.

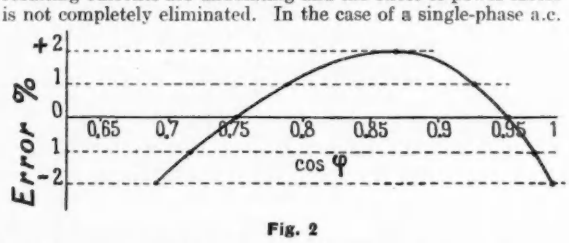


Fig. 2

load, for example, the deflection of an electrodynamic wattmeter fed with the undulating rectified voltage and current is subject to a periodic error varying with the phase angle ϕ of the load and reaching maxima of ± 23 per cent. (fig. 3).

Fortunately, most of this error arises from the first term in the Fourier series corresponding to the curve in fig. 3 and this term can easily be eliminated in measuring the phase volt-amperes of a polyphase circuit. All that is necessary is to feed the series winding of the instrument with the rectified current, and the shunt winding with a rectified pressure resulting from the superimposition of the rectified voltages of each phase. The periodic error due to load power factor is then theoretically

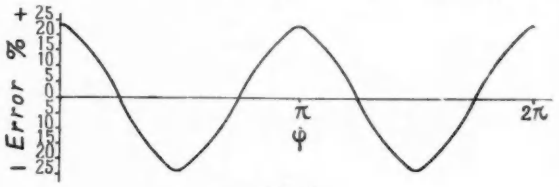


Fig. 3

within ± 0.89 per cent. for a two-phase load, and within ± 0.16 per cent. for a three-phase load. In practice, the errors are actually considerably smaller owing to the effect of inductance in reducing the amplitude and the effective product of the higher harmonics in the equation of error. The instrument thus virtually measures volt-amperes independent of power factor.

Where the load is balanced, the volt-amperes of one phase thus measured are proportional to the total volt-amperes. In the general case of unbalanced loads, it is only necessary to rectify the individual phase currents and superimpose them. Two current transformers are sufficient for a three-phase circuit, the secondary currents being combined vectorially and rectified as in fig. 4, where *a* represents current transformers; *b* voltage - reducing resistances; *c*, *d*, rectifiers for the shunt and series circuits respectively; *e*, fixed inductance coils; *f*, the moving coil of the instrument; S, the supply; and U the load.

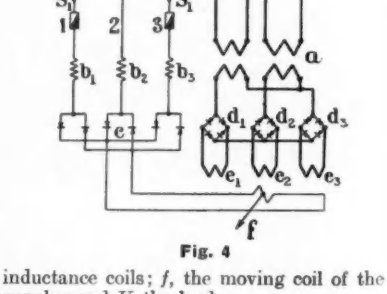


Fig. 4

A volt-ampere meter operating on this principle and recording on rectangular co-ordinates has been developed by the French Société Industrielle pour la Fabrication d'Appareils de Mesure, with rates of paper feed variable from 10-60, 60-600, or 600-7,200 mm. per hr. as required. The main current is reduced to 0.5 A, and the main voltage to 20 V for rectification; and the consumption of the instrument is relatively low, *viz.*, 9 VA per phase for the series circuit and 2 VA for the shunt.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

The Heayberd "Universal" Charger

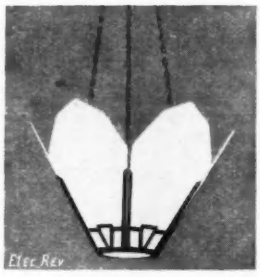
The new type "A.O.5" portable battery charger which has just been introduced by MESSRS. F. C. HEAYBERD & Co., 10, Finsbury Street, E.C.2, can be used for many purposes. Metal rectification is incorporated, and the output is 1 or 2 A at 2 V, 6 V, or 12 V. The choice of 1 or 2 A is obtained by means of a change-over switch. The 2-A rate can be used in the garage for charging motor car batteries, while the lower rate is suitable for wireless accumulators. It can also be used for energising 6- or 12-V moving-coil speakers, the provision of d.c. for low-tension eliminators, for driving model trains, lighting model cinematograph lamps, providing d.c. for small electro-plating plants and for experimental work in electrical, medical and scientific laboratories.

The Heayberd type "A.O.5" charger

The panel is of highly polished bakelite and the price is £4 10s. The dimensions are 9 in. by 5 in. by 5 in. and the charger weighs 10 lb.

A New Lighting Fitting

The EUSTON MANUFACTURING CO., LTD., 143½, Euston Road, N.W.1, announces that it is introducing a new lighting fitting. The glass panels are available in various colours and shades or plain frosted, and the price is 14s. finished in oxidised copper, or 18s. chromium plated. The horizontal circular base is obtainable in glass or translucent bakelite.



The new "Euston" fitting

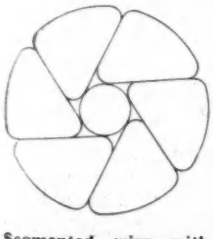
Interference Suppressors

In our issue of January 5th, 1934, we referred to the new interference suppressor consisting of two 2 mfd. condensers and fuses, made by the TELEGRAPH CONDENSER CO., LTD., Wales Farm Road, North Acton, W.3. There are, however, cases where a unit is required to effect further suppression. A new interference suppressor, known as No. 2, which comprises two 4-mfd. condensers in series giving double capacity, has, therefore, been introduced. This type is also fitted with protective fuses and three 12-in. rubber-covered leads for easy connection.

The unit is, of course, made in accordance with Post Office recommendations, and the price is 18s. 6d.

A Segmented-conductor Cable

The principal feature of the "Avis" cable is the use of segmented instead of stranded conductors which enables the mechanical and electrical stresses to be distributed over a larger surface (having a continuous and smooth periphery) as between conductors and as between conductors and lead. Although the thickness of the paper insulation is in accordance with the appropriate British Standard Specification, the decreased overall diameter, as compared with a stranded-conductor cable, permits a reduction in materials used, which is claimed to be 18 per cent. of the dielectric filling. A saving in copper for the same cross-sectional area is also effected owing to the formation of the conductor.



Segmented wire with solid core; overall diameter 0.325 in., core diameter 0.081 in.

The cable is designed to avoid air pockets within the lead covering or between conductors and dielectric. Stresses are further reduced in view of a smaller increase in the overall diameter due to temperature rise. Tests indicate that the power factor is improved owing to the continuous periphery, and that the closer spacing of the conductors reduces inductive drop. The sectional area at right angles to the axis is less than that of a stranded conductor owing to the reduced pitch diameter, angle of lay, and length of segment per unit length of equivalent capacity.

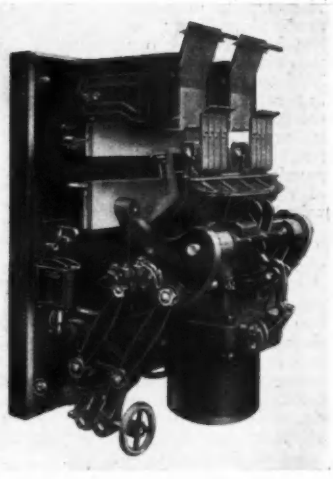
We were informed by Mr. Avis, the inventor, that 600-V cables constructed to his design and adhering strictly to the B.S.S. requirements for dielectric withstood a pressure test of more than twice that of a stranded conductor cable, and showed a saving of 21 per cent. on capital cost for copper, 16 per cent. for dielectric, and 13 per cent. for lead. With a reduced dielectric he anticipated that these figures would be 21, 26, and 22 per cent. respectively. Mr. Avis estimated that a 0.1-sq. in. segmented-conductor cable could be laid at a depth of 3 ft. across country at a cost 18 per cent. less than that of erecting an equivalent 11-kV overhead line.

The first installation of the cable is being made by Mr. F. R. C. Roberts, engineer and manager, Spalding U.D.C., Albion Street, Spalding, Lincs. The segmented conductor is also being used by Spalding U.D.C. in hard-drawn copper (steel cored) for ten miles of 11-kV overhead line, for which the SEGMENTAL WIRE CORPORATION, Africa House, Kingsway, W.C.2, is responsible.

A Swivelling-brush Circuit-breaker

MESSRS. WHIPP & BOURNE, LTD., Castleton, Manchester, have recently introduced an improvement in the design of their "Reliance" heavy-current air-break circuit-breakers for ratings of 3,000 A and upwards in the form of a swivelling brush. The main brush gear can be swung clear of the main contacts for inspection and cleaning.

With single-pole magnetic hand-operated breakers the brush gear can be swivelled out by removing the upper fixing nuts that secure the main bearing standards to the panel and front of the arcing chamber. The complete brush gear, operating mechanism, and bearing standards can then be lowered gradually clear of the main contacts by means of handwheels fitted on the underside which are unscrewed at an equal rate.



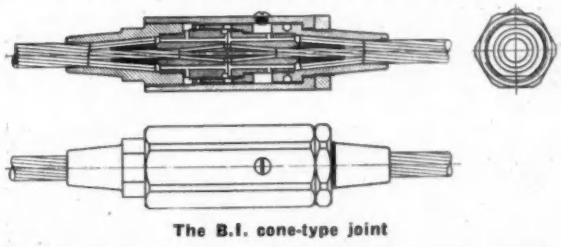
Swivelled-brush position of a 6,000-A, d.c. solenoid operated s.p. circuit-breaker

The movement is under the control of the operator throughout, and is carried out entirely from the front of the panel. With d.c. solenoid-operated circuit-breakers a handwheel moves a parallel device on each side of the main bearing standards, the securing nuts of which are removed. The hand-control swivelling gear can then be operated equally and gradually until the brush gear, operating mechanism, bearing standards and solenoid are clear of the main contacts.

Unions for S.C.A. Lines

In the latest pattern of cone-type joint manufactured by BRITISH INSULATED CABLES, LTD., for use in tension on overhead steel-cored aluminium strands, the stranded steel core is firmly fixed into a steel body piece by means of split cones, so tempered and tapered as to prevent the slipping of the steel core. On to this body piece an aluminium outer cone is screwed, into which are fixed the aluminium strands by means of an unsplit aluminium cone, through which the steel core passes with a small clearance. In this way the load on the aluminium strands is transferred to the steel body piece.

The outer cone is of the same high-quality aluminium as the strands. The softness of the aluminium of outer cone, inner cone, and strands allows a certain amount of movement of the strands when the joint is loaded, and is so arranged that at the breaking load the stress on the steel core and the aluminium is distributed in the correct proportion. The assembled steel body piece and aluminium outer cone form one half of the joint, the other half being similar. The two halves are joined by a steel sleeve with a collar at one end and



The B.I. cone-type joint

internally screwed at the other. The whole load carried by the cables is taken by this steel sleeve.

As, however, the conductivity of the sleeve is not sufficient for the electrical carrying capacity of the cable, a pure aluminium sleeve is provided connecting the two aluminium outer cones; this acts merely as a jumper between the two ends of the cables. A filling hole is provided in this sleeve by means of which the joint is filled with compound as a protection against internal corrosion. Large numbers of these joints are in use on the grid system, for both primary and lower-voltage lines.

An Improved "Rectigor"

Considerable modifications have been made by MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh, in the construction and design of the "Rectigor," a type of mercury-arc rectifier for battery charging from a.c. mains. The apparatus consists of a one-piece unit comprising switch panel, main transformer, choke coil, and rectifying bulb, the whole being enclosed in a perforated sheet-steel case, and suitable for bench or wall mounting.

A rear view of the "Rectigor"

Two separate charging circuits are now provided which give maximum charging currents of 4 and 2 A. The circuits may be used individually or simultaneously, or they may be paralleled to give a charging rate of 6 A. A voltage tapping plug is provided on the front of the switch panel, giving a choice of 6 and 30 battery volts.

The operation of the "Rectigor" depends upon the valve action of a mercury arc burning between two electrodes in an evacuated glass bulb, which allows current to pass in one direction only, *i.e.*, by way of the arcs from the two main anodes to the cathode or positive d.c. pole. The choke coil damps out the pulsations; auto-regulating resistances maintain the rectified current at a practically constant value, and at the same time reduce the voltage to a value which ensures adequate protection of the bulb in the event of a short-circuit between the anodes. The negative d.c. pole originates at the mid-point of the transformer secondary winding.

Cooker Control Units

New cooker control units made by the SIMPLEX ELECTRIC CO., LTD., Empire House, Gt. Charles Street, Birmingham, 3, have a number of attractive features. One type has an auxiliary circuit controlled by a special quick-action plug which renders an independent switch unnecessary. The design is such that inserting or withdrawing the plug breaks or makes contact at once with safety. The plug can be supplied with an additional 5-A fused-plug fitting into the body of the larger one. The 5- and 15-A types are interchangeable, allowing at will the use of 5 A only, 15 A only, or 5 and 15 A together. The price of the unit, which has the subsidiary circuit switch operated by the plug, is 21s. (10 A model), while the type with a special quick-action plug without a switch is 22s. 4d. for a similar rating.

A "Simplex" cooker control unit

An Unusual Wash-boiler

A brief description and illustration of the "Electrawash" wash-boiler, which is being made by the REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs, appeared in our issue of February 16th. The most interesting feature of this washer, which externally appears quite orthodox, is the method of operation. The inner container resembles that of an ordinary wash-boiler, but has two concentric rings of small holes drilled in the bottom at the centre and round the periphery. These connect to a lower compartment in which the water is heated by the elements which are clamped to the underside. Into this bottom compartment enters a pipe from the blower operated by a 1/6 h.p. motor which blows air under pressure. The air bubbles rising through the water set up an agitation, and as they force themselves with the water through the fabric of the clothes they remove the dirt. It would appear that cleaning the bottom compartment of the boiler after use presents difficulty. This is not the case, however, since by adding a small quantity of fresh water, heating it up, turning on the air pump and draining, the boiler virtually cleans itself.

A sheet metal outer casing encloses boiler, blowing mechanism, &c., and provides a rigid foundation for the hand-operated wringer which is attached to the cast top plate. A three-heat switch in a pocket in the boiler controls the elements and a separate switch is provided for the blower.

An All-insulated Portable Drill

To the range of portable electric tools marketed by the WESTMINSTER TOOL & ELECTRIC CO., LTD., Putney Bridge Road, S.W.15, has been added the Westool "Q" shock-proof drill. This model is completely enclosed in a moulded bakelite housing, with the exception of the chuck, which is, however, also insulated from the armature pinion by the use of reduction gear wheels made of impregnated fabric material. These wheels are employed to minimise noise and mechanical shock.

The Westool "Q" drill

The double-pole switch is of 15 A capacity, and is totally enclosed in a self-contained moulded bakelite housing. The motor is of the single-pole type with consequent pole, giving a somewhat better space factor, *i.e.*, a larger horse-power within a given space, and it has the further advantages of providing space for gear reduction without having a bulge on the side of the gearcase, and reducing the starting kick of the motor due to the armature being off the centre of the body of the machine.

Ball bearings are used throughout, a combined thrust and radial bearing being fitted at the end of the drill spindle to take the thrust and relieve the radial bearing of any endwise strain. The gear case is made of a specially light aluminium alloy, and in order to match the bakelite moulding is covered with a "Doverite" compound. The commutator is of moulded bakelite with reinforcing steel rings and is tested up to 20,000 r.p.m. It is of exceptionally large diameter, ensuring a large cooling surface, and a shroud which encircles the commutator affords protection from dust, damp and foreign particles. The tool is well ventilated. The moulding is made in two complete halves split through the middle, so that, by releasing a chromium-plated binding strap and two screws in the handle, the upper half of the casing may be removed, leaving the motor open for inspection. The drill capacity is 0.25 in. in steel and the price is £5 17s. 6d.

The Carron "Cadet" Cooker

Although very small, the new "Cadet" cooker (CARRON COMPANY, Carron) has a separate grilling chamber complete with a drop door, on the right of which are situated the two three-heat switches controlling the boiler-griller and the oven—there being no independent boiling plate. The oven, which measures 10 in. high by 10 in. wide by 11 in. deep, is heated by elements in the side loaded at 1,250 W, while the loading of the boiler-griller (10½ in. by 8 in.) is 2 kW. The cooker is recommended as suitable for three persons, it being possible to cook a 4-lb. joint with Yorkshire pudding or potatoes.

The Carron "Cadet" cooker

The "Pneu-flator"

An electrically driven tyre inflator priced at £16 10s. and suitable for all pressures up to 150 lb. per sq. in. is being made by B.E.N. PATENTS, LTD., Gorst Road, Chase Estate, N.W.10. It is known as the "Pneu-flator" and is specially recommended for use with the large tyres of trolley-buses, &c., but it can also be utilised as a high-pressure grease gun, blow gun or paint sprayer. For attachment to the "Pneu-flator" a combined automatic gauge, air control and universal chuck is available, costing £2 5s.

New Books

Text Book of Physics. By E. GRIMSEHL. Pp. 685; illus. London: Blackie & Son, Ltd. Price 25s.

This is the best type of educational text-book; its standard is that of a degree in physics, yet it is easy to read and understand. It deals with electrostatic and magnetic fields, the magnetic chemical and thermal properties of currents, conduction in solids, liquids and gases, electro-magnetic induction, alternating-current phenomena, oscillatory conditions and electro-magnetic waves. The general principles underlying electro-magnetic machinery, thermionic valves and wireless transmission are dealt with briefly, but from the physicist's point of view and not that of the engineer. Each section opens with a description of simple phenomena and the laws and properties to be deduced therefrom, and builds up step by step in logical sequence more complicated and difficult conclusions. The work is designed essentially for the use of teachers and students and is particularly useful for an experimental course. For nearly every step by which the various arguments are built up an experiment is described, all of which are easily demonstrated in a lecture theatre. Numerous illustrations show clearly the apparatus as set up for the experiment.

Though recent advance in the subject is not wholly ignored, the work is almost entirely devoted to "classical" physics and has little to say concerning quantum physics or wave mechanics. While this is entirely in accordance with the purpose of the work, it inevitably leads to the possibility of some confusion as soon as the properties of electrons and protons come under discussion. On page 322, for instance, it is deduced that an electron is a non-material particle. This deduction cannot possibly be made from classical physics, as the author attempts to do, but from the point of view of quantum physics there may be more justification for the statement. The translation, by L. A. Woodward, deserves high praise.

Leitfaden der Elektrotechnik—Vol. 1. Foundations of Direct and Alternating Current. By F. MOELLER and G. BOLZ. Pp. 210; figs. 152. Leipzig: Verlag B. G. Teubner. Price 9.60 Rm.

The outstanding merit of this book is that it presents an introductory treatment of the theory and principles of d.c. and a.c. circuits and effects and magnetic and electrical fields, in a manner meeting the requirements of students and practical engineers, without departing from scientific accuracy. Practical examples, numerical and constructional, are introduced freely; if the reader desires to proceed to more advanced works he will have nothing to "unlearn," and will have a thoroughly sound foundation of theoretical and practical knowledge. Only simple mathematics is employed and free use is made of graphical methods.

The book starts with a treatment of d.c. circuits, and within a few pages the reader is given a clear and precise explanation of units, methods of measurement, and a number of very instructive worked examples. This method of treatment is continued throughout so that, for example, consumers' circuits and ammeter shunts are dealt with immediately after Kirchoff's Law; furnaces, electric irons, welding, and incandescent lighting after the principles of heating, and so on. The treatment of the magnetic field is one of the best we have seen, particularly bearing in mind that the aim of the book is essentially practical.

The authors' genius for clear exposition is seen to special advantage in the second part of the book, dealing with alternating currents and a.c. circuits. Complex numbers and their uses, for example, are explained and illustrated in half a dozen pages, while vector diagrams are robbed of all their terrors by being printed in three colours.

* * *

Shorter Notices

"Easily Interpolated Trigonometric Tables with Non-interpolating Logs, Cologs, and Antilogs," by F. W. Johnson. San Francisco, California: Simplified Series Publishing Co. No. 6A, semi-loose leaf in paper covers, $1.85; No. 7, issued in flexible fabrikoid covers, $3.50. The new edition is an extension of Nos. 1 to 3 in the same series and enables four- or five-place values to be obtained without calculation. Marginal cut-out indices permit opening at any required value. The explanation and summaries are clear and the examples chosen for explanation are easily followed. All exposed tabs are lacquered as protection against dirt and wear.

The 1934 edition of "The Blue Book and Electrical Trades Directory and Handbook" (Benn Brothers, Ltd., 25s.) has just been issued, and contains the following new sections: Annealed copper conductors; dimensions of red fir poles, h.p. of motors, resistances and reactances of copper conductors at 50 cycles, international telephone service overseas (routes and rates) and a map of the grid scheme. All the usual features have been retained.

"The Practice of Engineering Estimating," by P. H. Miller. London: Oxford University Press. Price 12s. 6d. This work deals with estimating for general engineering construction. A large amount of information has been condensed into convenient tabular form and the methods of building up fully detailed specialised estimates are dealt with at length.

"A Notebook of Mathematics," by G. T. H. Cook. Pp. 67, with diagrams. London: Sir Isaac Pitman & Sons. Price: 2s. 6d. This book is compiled for engineering students preparing for the National Certificate and Intermediate B.Sc. examinations All essential formulæ and theorems are included, and it indicates the method of proof, while in special cases worked examples are provided.

A new Science Museum handbook which we have received is called "Electric Power," Part II (2s.). It contains the substance of the detailed descriptive labels associated with the exhibits in the Electric Power Collections. Attention has been directed to some of the more important items by marking them with asterisks. Telegraphy, telephony and radio are not included in this book, and the general history and development of electric power, irrespective of individual objects in the museum, was dealt with in Vol. 1, reviewed last year.

The 1934 edition of the "Electrical Engineers' Year Book" (S. Davis & Co. (Aldwych), Ltd., 21s.) has just been issued. It contains all the usual features, which have been revised, and also a list of the members of the Electrical Contractors' Association. One of the most useful features of this work is the list of London streets in which mains are laid, giving full details of the supply, and a list of undertakings in the country with particulars of the system of supply and the tariffs.

Economy and Progress

Views expressed at the Birmingham E.D.A. Dinner

THE dinner of the E.D.A. South Midland Area, held at Queen's Hotel, Birmingham, on March 1st, was presided over by the area chairman, Mr. F. Nicholls, borough electrical engineer, Derby. Mr. F. J. Marquis (president, Incorporated Association of Retail Distributors), proposed the toast "Trade and Industry." He suggested that E.D.A. should draw up plans in conjunction with retail distributors to place before the public at reasonable prices goods that should be installed by skilled electricians. The remarkable spurt in trade last November he attributed to the prospect of the reduction in the proportion of income tax payable on January 1st. He hoped for an early restoration of salary cuts and some remission of taxation, but he urged as a trader that the cuts should be restored first in order to increase the desire and capacity to spend.

Sir William Ray, M.P. (executive chairman, E.D.A.), responding, said that no permanent return to prosperity could be expected until certain forms of public expenditure had been reduced, but the official report with which his name was associated did not relate to municipal trading undertakings, and he believed that where such undertakings were in existence the utmost should be made of them. He was in favour of a restoration of all cuts, but the greatest handicap in the face of foreign competition was high taxation and local rates. If we were forced to become self-contained, as other countries were becoming, a reduction in export trade would not be so serious provided our home market were expanded in compensation.

Sir William then proposed the toast of the Birmingham and other electricity undertakings in the South Midland Area to which Sir Percival Bower (president-elect E.D.A.) responded. Sir Percival said that the electrical industry had suffered from the use of inferior appliances, to which a number of accidents had been due, and fear of electricity must be eradicated from the public mind. The effect of trade revival was illustrated by his own undertaking (Birmingham) in the increase in industrial output during the last completed year. E.h.v. supplies to large power consumers had been 290 million kWh, an increase of 40 million or 15.9 per cent. over the previous year, the figure being 10 million kWh in excess of the highest previously touched. Sales for all purposes increased by 49 million kWh (11.6 per cent.) to 471 million kWh, and the maximum load just before Christmas reached 202,700 kW, on which day 2,650,000 kWh was generated, or 15 per cent. increase over any day in 1932. Forty large factories with an aggregate h.p. of 21,000 had been connected to the e.h.v. distributors. Domestic connections had increased in the same period by 16,750 kW to over 100,000 kW, and during the last five years the increase had been 70,000 or 100 per cent. Total connections were now 511,000 kW, an increase of 40,000. The number of consumers was 150,000, the largest for any municipality. Last year 148 miles of mains were laid, bringing the total to 2,182 miles.

Mr. Jennings proposed the health of the chairman and also of the first chairman of the Area—Mr. R. A. Chattock—both of whom briefly responded, the former making special reference to the work of Lt.-Col. A. E. Neal, the Area Officer.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

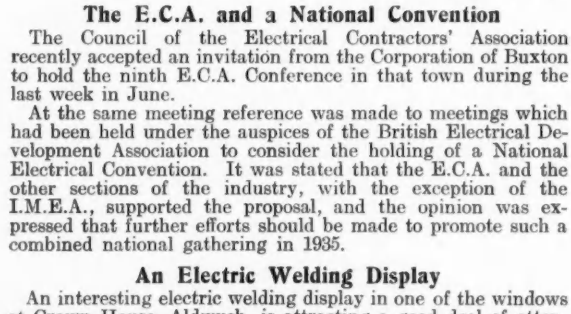
The E.C.A. and a National Convention

The Council of the Electrical Contractors' Association recently accepted an invitation from the Corporation of Buxton to hold the ninth E.C.A. Conference in that town during the last week in June.

At the same meeting reference was made to meetings which had been held under the auspices of the British Electrical Development Association to consider the holding of a National Electrical Convention. It was stated that the E.C.A. and the other sections of the industry, with the exception of the I.M.E.A., supported the proposal, and the opinion was expressed that further efforts should be made to promote such a combined national gathering in 1935.

An Electric Welding Display

An interesting electric welding display in one of the windows at Crown House, Aldwych, is attracting a good deal of attention. Seated at his job, the figure of an operator is seen welding a small tank, the colours from the arc flashing on to his face mask. The only other lights in the window illuminate two showcards, whilst a neon monogram hangs overhead. Two of the smaller types of " Metrovick " welding sets are shown,



Electric welding in a shop window

a d.c. and an a.c. equipment. This display, which was designed by the Metropolitan-Vickers Electrical Co., Ltd., shows that even engineering products lend themselves to novel treatment.

Higgs Motors Again Extend

We are pleased to learn from Messrs. Higgs Motors, Ltd., of Witton, Birmingham, that their sales for the first two months of 1934 show an increase of 56.7 per cent. over those for the corresponding period of last year. The company's record of progress has been a remarkable one, and the output for 1933 constituted a record since the formation of the concern in 1912; the directors are confident, however, that still greater progress will take place in the future, and they are preparing for it. Since the year 1927 the works have been extended eight times, and the ninth extension has just been put in hand; it consists of another building addition of 12,000 sq. ft. to the main engineering works.

Leeds Contractors' Dinner

The importance of encouraging the education of young people in the trade was emphasised by the deputy Lord Mayor of Leeds (Councillor B. W. Goodall) in proposing the toast of " the Electrical Contractors' and Allied Associations " at the annual dinner of the West Riding branch of the E.C.A. held at Leeds on February 28th. Councillor Goodall said that by encouraging apprentices to take scholarships and win prizes the E.C.A. was co-operating with the educational authorities who were doing their best to improve the standard of technical education. Mr. L. C. Penwill, director and secretary, responded, and emphasised the need for co-operation in the electrical industry. Those present included Mr. Walter Robb, chairman, and Mrs. Robb, Mr. A. Smith, chairman of the Northern Sectional Board, Mr. J. Gaunt Craven, Mr. C. Nelson Hefford (Leeds city electrical engineer), and Mrs. Hefford, Mr. Percy Collinson and Alderman C. V. Walker.

Electric Welders' Wages

The Federation of Shipbuilding Employers has posted notices in all its yards intimating that its scheme for the payment of electric welders will apply in all Federation shipyards as from the first full pay week in April. It will apply only to time rates and will not interfere with piecework prices now in operation. In the case of new work, establishments where time rates for electric welders of varying amounts in excess of 60s. weekly are operating the notices indicate instalments by which these rates will be brought into conformity with the national time rate of 60s., including 10s. bonus, for a week of forty-seven hours. The union mainly affected is the Boilermakers' Union, as eventually riveters, caulkers and others will be displaced by electric welders. It will take some time before the new process will be sufficiently general in operation to displace a large volume of such labour.

New Electricity Showrooms

Electricity showrooms established in the Carfax by Horsham Urban District Council were opened on February 26th by the chairman of the Electricity Committee.

Austrian Radio Works in England

It is reported that the Ver. Gluhlampen und Elektrizitäts A.G. of Neupest has now carried out its intention, which was reported a short time ago, of establishing a company in England under the title of the Tungsram Radio Works, Ltd., with a share capital of £10,000, for the purpose of producing radio

An Electrical Day at the Fair

AT the official British Industries Fair luncheon to representatives of a number of electrical organisations on March 1st the Hon. Oliver Stanley, M.C. (Minister of Transport), proposed the toast " Industry." The electrical industry, he believed, would provide the only possible answer to the question as to the effect of machinery on the lives of men : *viz.*, by the creation of new demands that would have to be satisfied. Unemployment in the electrical industry on January 22nd, 1932, was 18.6 per cent.; on the corresponding day this year it had fallen to 11.8 per cent. Recovery to the level of 1929 would not be enough; advance planning was necessary and a will to co-operate and courage to take risks for which a reward would undoubtedly be forthcoming. The common object of the whole industry was to sell as much electricity as possible not only for economic reasons but because it had to fulfil a responsibility in bringing to the humblest homes the advantages made available by science.

Mr. P. J. Robinson (President I.M.E.A.), in thanking the Minister of Transport for his address, emphasised the importance of standardisation and mass production in the manufacture of the smaller domestic appliances with a view to their being marketed at low prices, which would lead to a demand for the production of heavier plant also.

Good Electrical Business

The following report was officially issued at the close of the Fair on Friday evening from the headquarters offices with regard to business in the Electrical Section :—

" To a large extent the business done—which some of the large exhibitors described as ' most encouraging '—was with local authorities and retail traders in the United Kingdom. In the main, this business was for street-lighting equipment, automatic traffic controls, new applications for industrial uses and for general accessories and domestic equipment for heating and cooking. It was reported also that there was a definite improvement in the exports of the smaller products of the industry, including domestic apparatus.

" A more confident note characterises trade with South Africa, some of the inquiries received being of a most promising character. On all sides there was proof of a much wider application of the use of electricity for motive power in industrial operations and in agriculture. . . A number of orders from overseas were placed for power plant. Many exhibitors have applied for increased stand space at the next Fair."

Proposed Change of Date

The Management Committee of the Birmingham Section of the Fair has passed a resolution in favour of altering the date of the Fair from February-March to May-June, and has written to the Department of Overseas Trade expressing the hope that the two London sections of the Fair will also be changed to the latter date. A Committee representing the London and Birmingham Sections has been appointed to consider the matter and to report to the D.O.T.

The total attendance at the Birmingham section was 124,507, compared with 110,510 last year. The figures for the London sections are given as: overseas buyers 12,008, home buyers 114,339.

valves for the English and British colonial markets. The object is to retain markets which may be lost through the increase in the English import duties.

Turbo-alternators in Paper Mills

In an article on this subject which appeared in our issue of March 2nd (p. 302) it was stated that "In addition to the turbo-alternators and switchgear, the B.T.-H. Co. also manufactured and installed the complete electrical equipment for driving the paper machines in this mill." The Harland Engineering Co., Ltd., says that this may create an erroneous impression in the minds of our readers, because the last paper machine installed at Messrs. Bowater's Mersey Paper Mills, Ltd. (their No. 4 machine) is driven by the Harland patent sectional interlock drive, and was manufactured and installed by that company.

Japanese Electrical Imports and Exports

Although imports of electrical goods into Japan have not varied greatly in value during the past three years, they are less than half the level of 1929. Total values (in thousands of yen) were: 1929, 14,267; 1930, 7,765; 1931, 4,232; 1932, 3,952; and 1933, 5,180. The following table shows the principal items of import last year, with notes of increases or decreases in value compared with 1932. The only noteworthy advances were in telegraph and telephone instruments other than radio material.

	1932. Yen (thous.)	1933. Yen (thous.)	Inc. or dec. Yen (thous.)
Ammeters and voltmeters	101	79	— 22
Wattmeters	211	99	— 112
Accumulators and dry batteries	176	106	— 70
Telegraphic instruments	220	384	+ 164
Telephonic instruments	1,450	2,606	+ 1,156
Including radio receiving sets	490	340	— 150
Dynamos and motors, not over 100 kg. ...	1,410	1,370	— 40
Dynamos and motors not over 5,000 kg. ...	234	192	— 42
Dynamos and motors, other	4	170	+ 166
Transformers	111	65	— 46
Dynamo sets	47	113	+ 66
Insulated electric wires, including submarine	202	75	— 127

In the group comprising dynamos, transformers, &c., the principal countries participating in the trade, with the share of each, is shown below:—

Destination	1932. Yen (thous.)	1933. Yen (thous.)	Inc. or dec. Yen (thous.)
Totals	1,755	1,800	+ 45
Great Britain...	166	131	— 35
France...	46	84	+ 38
Germany	723	985	+ 262
Switzerland	197	163	— 34
U.S.A....	593	376	— 217

Exports of insulated wire were 4,598,000 yen in value last year as against 1,997,000 yen in 1932 and 2,366,000 yen in 1931; of telephone instruments, 2,835,000 yen, 642,000 yen and 521,000 yen; of electrical machinery, 2,724,000 yen, 1,415,000 yen and 2,686,000 yen; and of electric lamps, 10,167,000 yen, 10,187,000 yen and 5,875,000 yen respectively.

Recent Contracts

Derby Cables, Ltd., has obtained an order for 180 metres of 3-core, 190 sq. mm. armoured cable to V.D.E. specification for Kristiansund Electricity Works, Norway. This order was secured against keen foreign competition.

The English Electric Co., Ltd., has secured a contract from the Thames Steam Tug & Lighterage Co. for a complete Diesel electric tug. The tug will be of the barge-handling type and will operate on the River Thames. The equipment will consist of two "English Electric" Diesel-generating sets with auxiliary generators and all the necessary engine room auxiliaries in connection therewith. The propelling motor will be of the double armature type, capable of developing

West Riding Rovers being shown the process of electric welding at the English Electric Co.'s Bradford works

400 s.h.p. at 100 r.p.m. and will be capable of running at any speed from 0/130 r.p.m. Dead-front switchgear will be supplied. The Diesel engines, generators, switchgear and all other electrical equipment will be manufactured at the English Electric works at Rugby and Stafford, and the hull will be built by Messrs. J. I. Thornycroft & Co., Ltd., Southampton.

Artistic Church Lighting

We are informed that the photograph which accompanied the note bearing this heading in our February 23rd issue (p. 282) showed the Church of St. Paul, Apostle and Martyr, and not Chipping Barnet Parish Church as stated.

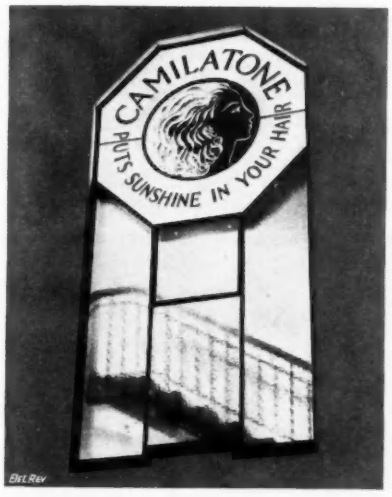
Trade Announcements

Messrs. Webling & West, radio and electrical engineers, have opened premises at 4, White Hart Street, Thetford.

Mr. Leech, electrician and radio engineer, has taken premises in the new shopping centre at Independent Buildings, Kirkdale Road, Leytonstone.

Local Exhibitions

The Electrical Distribution of Yorkshire, Ltd., is holding an exhibition of farm appliances driven by electricity at Electricity House, 24, Thorne Road, Doncaster.



This attractive G.E.C. sign, which employs "Osram" lamps, has been installed by Messrs. E. Wight & Co. at the Camilatone factory at Hendon and is incorporated in a window of the building

The Gravesend Electricity Department (engineer, Mr. C. F. McInnes) is this week holding one of its periodical exhibitions at the Town Hall. The local contractors, who recently formed a branch of the Electrical Contractors' Association, have a bright and varied display, while the Department itself is making a feature of its hire and hire-purchase items: Jackson cookers, "Sadia" water heaters and "Burco" wash boilers. The Department offers attractive terms and sells energy on an all-in two-part tariff with ½d. per kWh running charge. There are about 10,000 consumers, of whom 1,200 already have cookers. The Jackson Electric Stove Co., Ltd., has sent demonstrators to the exhibition and they are attracting good audiences.

Electrical Appliances for Palestine

Of recent years a big movement for the use of electricity has been going on in the Holy Land. This has been brought about by the influx of Jews from Europe, bringing with them Western ideas in home comforts, and in business and manufacture. Now all the large towns and a number of the villages are lighted by electricity in the streets and houses. Even inside the Old City of Jerusalem the Oriental bazaars are illuminated by electricity, and on more than one occasion the Great Mosque has been floodlighted.

So far use of electricity in the household has been confined to illumination, but now it is coming into use for cooking and heating. For many years oil or coke have done duty in these directions, but with the cheapening of the charges for supply electricity is bound to make headway among housewives. It is interesting to record that a "Household Consultation Station" has been set up under the direction of Dr. Erna Meyer, an expert of the reform movement for national household management in Germany.

This "Station" will familiarise women, by demonstrations and lectures and pamphlets, with all the modern apparatus for making housekeeping easier. Here we have then an opportunity for manufacturers of electrical appliances to get a trade footing in Palestine. Traders are looking eagerly for British-made goods, which have a remarkable reputation for value in the Holy Land, and British salesmen should profit accordingly.

Palestine, untouched by the economic blizzard and with no unemployment, offers an ever-expanding market to the exporter. The people's standards of living are rising daily. Our own Government has recognised the commercial potentialities of the country by sending out a special Trade Commissioner, whose job will be to link up Palestine importers with English manufacturers. At the Levant Fair at Tel Aviv a special British Pavilion has been erected.

The Marking of Imported Valves

The Board of Trade announces that an Order-in-Council was made on February 26th under Section 2 of the Merchandise Marks Act, 1926, *viz.*, the Merchandise Marks (Imported Goods) No. 1 Order, 1934, which requires imported goods of the following descriptions to bear an indication of origin: (a) Thermionic valves dissipating a dead loss at the anode not exceeding 50 W (b) Rectifying valves not exceeding a capacity of 60 VA or passing a current of more than 1 A. This Order,

which will come into force on May 26th, is being published shortly.

Prices of Materials

Messrs. F. Smith & Co. report March 7th: Copper (electrolytic) bars, £36 5s., 5s. inc. Ditto, ditto, wire rods £42, 5s. inc. Silicium bronze wire, no change.

Messrs. Edward Till & Co., report, March 7th: No change in the price of india-rubber, Para fine.

Messrs. James & Shakespeare report, March 7th: No change in the price of copper bars (best selected) sheet and rod, and English pig lead. Electrolytic copper sheets, £35 10s. to £36 5s., 5s. to 10s. inc.

Edison Institute Conference

A two days' commercial conference of the Edison Electric Institute is to be held next week—March 14th and 15th—for the discussion of load-building problems. Utility representatives, manufacturers, distributors and dealers will all be present.

The Illumination of the City Hall, Capetown.

Referring to the illustration in our last issue showing the illumination of the City Hall, Capetown, the "Beeantee" Illuminations, Ltd., informs us that a large number of "Beeantee" holders were used in this scheme.

The Old Cromptonians' Association

The annual dinner of this Association will be held at the Hotel Metropole, W.C., on June 1st, when the president, Col. R. E. Crompton, will be in the chair. Full details can be obtained from the secretary, Mr. H. H. Spencer, Bush House, Aldwych, W.C.2, who would be glad to hear from all Old Cromptonians—whether members of the Association or not.

Sir Kingsley Wood, the Postmaster-General, inspecting teleprinter machines during a visit to the Croydon works of Messrs. Creed & Co.

The Prague Spring Fair

At the spring session of the next Prague Fair, to be held from March 11th to 18th, a special section covering electricity in the household and in industry will be organised in co-operation with the Czechoslovak electrotechnical associations.

Two D.O.T. Reports

The Department of Overseas Trade has issued to firms on its special register confidential reports on the market for radio apparatus in the Netherlands and the market for road traffic signalling apparatus in Greece.

The German Cable-manufacturing Industry

The Reich Minister for Economic Affairs has recently devoted attention under the new cartel law to the situation of the branches of the electrical industry which produce h.p. cables and insulated conductors with a view to preventing unprofitable developments. The makers of h.p. cables are embodied in one syndicate and the twenty-two works producing l.p. cables are incorporated in a second combination of this kind, and both these syndicates were renewed at the end of February for a period of five years. Many producers of insulated conductors are united in an organisation termed the "Vauelfa," while still other and independent makers have recently constituted an independent combination under the name of the "Ifkafa." It has been found that these independent makers undercut the prices of the "Vauelfa." In order to prevent any unsound developments in the production of either h.p. cables or insulated conductors, the Minister has now issued an ordinance placing a restriction on the manufacture of these particular products, which in the case of h.p. cables are only being turned out to the extent of about 50 per cent. of the output capacity of the works concerned. The ordinance which was brought into force on February 25th, extends to the end of the year. During this period, the *Frankfurter Zeitung* states, the Minister has placed a veto on (1) the establishment of new undertakings for the manufacture of h.p. cables or insulated conductors; (2) an increase in the output capacity of existing undertakings; and (3) an extension of the activity of existing undertakings to the production of h.p. cables or insulated conductors. The veto does not apply to cables for telegraph or telephone purposes, as this business is practically limited to State orders. The agreement binding the "Vauelfa" syndicate will expire at the end of March, and its managers are now seeking to bring about a renewal and to come to an understanding with "Ifkafa."

Catalogues Wanted

Messrs. Mizrah Frères (B.P. 26), Damascus, Syria, who hold agencies for a number of electrical concerns, ask for general catalogues of electrical materials, particularly wires and cables, and lists giving prices c.i.f. Beyrouth.

Social Events

The annual staff dinner of the North Metropolitan Electric Power Supply Co. was held on Tuesday last at Park Lane Hotel, W., Lord Ashfield, chairman of the company, presiding. In proposing the toast of "The Northmet Company," Mr. E. R. Soames said that the past year had seen the acquisition of the Harrow Electric Light & Power Co. and the undertaking of the Bishops' Stortford, Harlow and Epping Gas & Electricity Co. The year had also been the best in the history of the company and they had confidence in the future, and in Mr. J. M. Donaldson, their engineer, and Mr. Boyd, the secretary. Lord Ashfield, in responding, said the past year was an outstanding one in the history of the company, and the sale of 352 million kWh conveyed some idea of the important position in which the company found itself to-day. Direct consumers now totalled 130,000, and, including those supplied indirectly, the total was 219,000. Although the immense growth of the area played a large part in their progress, a great deal was attributable to the company's service. In 1919 the area of supply was 326 square miles, while to-day it was 660 square miles. Again, in 1919, only 53 million kWh was sold, against the figure for last year already mentioned. During the same period the capital expenditure on the undertaking had risen from £1,000,000 to £9,000,000, and the staff from 700 to 2,700. Consumers had benefited by reduced charges, and shareholders and the staff had also shared in the prosperity of the undertaking.

Mr. J. M. Donaldson, in proposing "The Guests," said that their largest individual consumer now was the London Passenger Transport Board, to which they supplied 59,000,000 kWh last year for a section of the tramway and Underground systems. Willesden Borough Council, which previously held first place, was now second, with 54½ million kWh. Mr. S. E. Baker, the company's solicitor, responded, and the health of the chairman was proposed by Mr. J. E. Blair.

The G.E.C. Dramatic Society is presenting "Baa, Baa, Black Sheep," by Ian Hay and P. G. Wodehouse, at the Fortune Theatre, W.C., on March 19th and 20th. As in previous years, the proceeds will be given to the Infants' Hospital, Westminster.

The Basingstoke Electricity Department's Social Club held its first annual dinner and smoking concert at the Station Hotel, Basingstoke, on March 1st. After dinner, the company was entertained by its own band, augmented by solo items rendered by members of the Club. Entertainers engaged for the evening completed an enjoyable programme, which was distinctive if only by reason of ingenious floodlighting effects. Mr. W. E. Jones, borough electrical engineer, was in the chair, and a visit was paid by the Mayor of Basingstoke, Councillor R. Howard, who is also chairman of the Electricity Committee.

New Catalogues and Lists

Record Electrical Co., Ltd., Broad Heath, Altrincham, Cheshire.—A sixty-four-page pocket catalogue giving illustrations and details of the company's complete range of manufactures.

B. E. N. Patents, Ltd., Gorst Road, Chase Estate, N.W.10.—A leaflet describing the new "Pneu-Flator."

Simplex Electric Co., Ltd., 219, Tottenham Court Road, W.1.—Complete catalogue of ironclad switch and fuse-gear.

Marryat & Scott, Ltd., 75, Clerkenwell Road, E.C.—Leaflets on various Marryat-Scott lifts.

S. Wolf & Co., Ltd., 115, Southwark Street, S.E.1.—Leaflet on Wolf electric tools.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Leaflets on transformers, switchgear, instruments, fuses, plugs, circuit-breakers and contactors.

Potters, Ltd., Westland Works, Yeovil.—A special marine issue of "Potter's Monthly News."

British Aluminium Co., Ltd., Adelaide House, E.C.4.—A book on powdered and granulated aluminium.

Venner Time Switches, Ltd., Kingston By-Pass, New Malden.—An illustrated reprint from the ELECTRICAL REVIEW dealing with prepayment meters.

Switchgear and Equipment, Ltd., 49, Queen Victoria Street, E.C.4.—A leaflet on a l.p. strain type fuse.

English Electric Co., Ltd., Stafford.—Catalogues on rectifiers, turbines, tramcars, cookers, water heaters and fires.

Medical Supply Association, Ltd., 167, Gray's Inn Road, W.C.1.—Catalogue G.E.D.2, giving details of some new electro-medical apparatus suitable for a.c. mains.

Aidas Electric, Ltd., St. Leonard's Road, Willesden Junction, N.W.10.—Leaflet illustrating and describing a new "Type G" water heater.

Bankruptcy Proceedings

D. Tweedle, 42, Market Street, Milnsbridge, Huddersfield, Yorks, radio and electrical engineer.—The first meeting of the creditors herein was held on February 27th, at the Official Receiver's office, 71, Manningham Lane, Bradford, when the statement of affairs showed gross liabilities of £132, of which £126 was expected to rank for dividend, and assets of £44, leaving a deficiency of £82. The position was attributed to

insufficient turnover and bad debts. The matter was left in the hands of the Official Receiver as trustee.

H. J. Couzens, 165, Young Street, Sheffield, electrical contractor.—Unsecured liabilities of £2,506, with a deficiency of £1,662, were disclosed at the first meeting of creditors held on February 28th at the Official Receiver's office, Sheffield, when Mr. H. Cunningham, King's Chambers, Angel Street, Sheffield, was appointed trustee.

C. H. Fisher, 3, New Road, Durrington, Wilts, electrical and wireless engineer.—The public examination was held at the Guildhall, Salisbury, on March 1st, when it was disclosed that the liabilities amounted to approximately £146, and there was a deficiency of £138. The examination was closed.

H. G. Lawson (E. Cooper), radio and electrical dealer, 1002, Stratford Road, Hall Green, Birmingham.—Receiving order made February 27th on debtor's own petition.

W. S. Fray (R. E. Warren), electrician, 1, Albert Road, Torquay.—First meeting March 9th at Exeter Bank Chambers, Broadgate, Exeter. Public examination April 18th at the Castle, Exeter.

E. C. G. Hefti, electrician, 10, Dean Road, Scarborough.—Discharged as from March 6th, subject to bankrupt's consenting to judgment being entered against him by the Official Receiver for the sum of £170.

N. Sutton (Sutton's Wireless Service), wireless dealer, 169, High Street East, Wallsend.—Trustee, Mr. R. Betts, 81, St. Mary's Place, Newcastle-upon-Tyne, Official Receiver, released February 9th.

W. V. Longthorp (Evans & Co.), wireless dealer, Farnham Road, Slough, and at Windsor.—Trustee, Mr. J. B. Simmons, 3, Forbury, Reading, released February 9th.

W. R. Blakeway (Pearson & Co.), electrical contractor, 31, High Street, Southampton.—Supplementary dividend of §d. in the £, payable March 16th at 44, Above Bar Street, Southampton.

A. L. Pearce, electrical supplies dealer, 12, Fore Street, New quay.—Receiving order made February 24th on debtor's own petition. First meeting March 10th at 12, Princes Street, Truro. Public examination April 10th at the Town Hall, Truro.

S. J. Garrod (Electrical Repair & Manufacturing Co.), electrical engineer, 181, St. John Street, E.C.—First and final dividend of 3s. 8½d. in the £, payable March 9th, at Balfour House, Finsbury Pavement, E.C.

Company Liquidation

Lunar Electrical Co., Ltd., 7, New Street Square, E.C.—A compulsory winding-up order was made against this company on January 22nd and the statutory first meetings of creditors and shareholders were held on March 2nd at the Board of Trade Offices, Carey Street, W.C. Mr. G. W. Hutcheson, Assistant Official Receiver, reported that as no statement of affairs had been furnished, he could not state the amount of liabilities or assets, but he had received twenty proofs of debt aggregating £10,934. The company was formed in November, 1926, to acquire the business of the Lunar Electrical Co. carried on by W. R. Preston and A. M. Scales. Although the transfer was effected in November, 1926, the sale agreement was dated February 27th, 1929. The purchase price was £612, payable as to £514 in cash, and £98 in fully paid shares. Preston & Scales acted as joint managing directors. The company dealt primarily in household lamps, the business in which was only started in February, 1926. Both Preston & Scales had been associated with three other concerns which carried on business as factors or agents; all orders received by them were passed on to the company for execution and the prices charged by the company to those three concerns left a profit to the company. At the end of March, 1932, they were shown as book debtors to the extent of £3,586. On the other hand Preston had stated that A. P. Maglen, Ltd., of which he and his wife were directors, which occupied the same premises as this company and had the same staff, were creditors of this company for between £1,000 and £1,500. It appeared that Preston had guaranteed payment of some of the company's debts on the condition that he was given a debenture as security for any such payments. A 6 per cent. debenture bond for £5,700 was issued to Preston on April 10th, 1933, and on January 2nd, 1934, he obtained the appointment of Mr. A. J. Learridge as receiver on his behalf. The failure of the company was attributed by Preston to the keen competition in certain foreign and cheap British lamps which occasioned a loss of turnover and a much lower ratio of profit. Scales attributed it to lack of working capital, caused by the indebtedness of the three before-mentioned concerns to the company. The liquidation was left in the hands of the Official Receiver.

Private Arrangement

Magnacore, Ltd., 85, Alsen Road, Holloway, N.7, manufacturers of radio and electrical accessories.—Mr. F. S. Sharles, London Wall, E.C., the receiver for the debenture holder, convened a meeting of creditors on March 1st. No statement of affairs was submitted, but the receiver said that the liabilities amounted to £6,139. There were also debentures and interest amounting to £2,993, but the assets were estimated to realise only £2,269. The company was incorporated in September, 1932. One of the directors of the company said that the firm had been hit by the slump which occurred in the spring of last year, and in the first four months of the company's trading, which was confined to experimental work, there was a loss on trading of £250. The company carried on in the hope that trade in the autumn season would improve. In order to help the position the company decided to manufacture motor car ignition coils as well as wireless transformers, and electrical appliances. A great deal of time was spent on making perfect the ignition coils, and it was not until January of this year that the company was able to market them. For 1933 there was a gross profit of £378, and a net loss of £2,748. It was resolved that the necessary steps should be taken by the directors of the company to put the company into voluntary liquidation. The following are creditors: British Insulated Cables, Ltd., £70; Connollys (Blackley), Ltd., £110; G. L. Scott & Co., Ltd., £100; Mica Products, Ltd., £268; Magnetic & Elec. Alloys, Ltd., £265; Joseph Sankey & Co., Ltd., £302; Scott Insulated Wire Co., Ltd., £102; West Insulating Co., Ltd., £997.

Electricity Supply

Lighting, Domestic, Power

Alston.—SUPPLY SHORTLY.—Preparations are being made to bring electricity to Alston *via* Hartside. The work is being carried out by the Mid-Cumberland Electricity Co., Ltd.

Australia.—PROPOSED NEW GENERATING STATION.—It is proposed to erect a new electricity generating station at the head waters of the Kiewa River to supply north-east Victoria and the Riverina. Exploration work has been undertaken, and the Minister in Charge of Electrical Undertakings, Mr. Macfarlan, has recently visited the proposed site.

Barking.—SPECIAL TARIFF.—The Electricity Committee recommends that in view of the demand for large heating installations it is desirable to institute a special rate of supply for this purpose, and proposes a heating, cooking, and water-heating (restricted supply) rate at 0.75d. per kWh.

NEW FEEDERS.—The Electricity Committee is to lay new feeders to the White Horse, Heath Street, Westbury Hotel, and Ripple Road (St. Paul's Road) and divert the existing White Horse feeder to London Road, at a total estimated cost of £4,634.

EQUIPMENT REQUIRED.—It was reported that the estimated cost of public lighting mains, distributors, feeders, and sub-station equipment for the Manor Farm Estate amounted to £15,015, and it was decided that tenders should be invited for the sub-station equipment and supply of the e.h.p. feeders required.

CONVERTING PLANT TO ELECTRIC DRIVE.—The Sewerage Committee is to convert the existing plant at Creeksmouth ejector station to electrical operation at an estimated cost of £750.

Belgium.—ELECTRICITY SUPPLY PROGRESS.—Last year the number of electric power stations increased from 226 to 250. The companies affiliated to the Belgian Electrical Development Association produced altogether 1,714,364,000 kWh and the Association of Industrial Power Stations 1,607,304,320 kWh, while private and industrial producers not belonging to the associations mentioned produced 419,276,226 kWh and municipal stations 160,960,753 kWh. Thus the total electrical output in Belgium last year was about 3,900 million kWh.

Bradford.—NEW EQUIPMENT.—The Electricity Committee has approved two schemes estimated to cost £33,000. One is to provide additional equipment needed by the adaptation of the Thornton and Lidget Green tram routes for railless vehicles and the other is to bring the switchgear at Odsal sub-station up to date.

Coates.—NEW SUPPLY.—The Peterborough Corporation has received sanction to borrow £2,750 for the supply of electricity to Eastree and Coates by overhead lines.

Darlington.—LOAN.—The Town Council is to apply for sanction to borrow £40,000 for the provision of generating plant, boilers, and a cooling tower at the power station.

Eastbourne.—MAINS IMPROVEMENTS.—The Electricity Committee is to strengthen the distribution system at a cost of £9,432.

East Ham.—NEW EQUIPMENT.—The Electricity Committee has approved an estimate of £4,543 for additional equipment for three sub-stations and switchgear cables and fire-extinguishing equipment at Nelson Street, and is to extend feeder and distribution cables at a cost of £16,425.

Epsom.—CHANGE-OVER POSTPONED.—The Urban District Council, instead of changing over from d.c. to a.c. in the Hook Road district, has decided to boost the voltage by means of mercury-arc rectifiers, costing £3,600, and to renew a portion of the mains at an outlay of £1,350, and a loan of £4,950 is to be applied for. The cost of changing over was estimated at £5,000. A similar step is to be taken in the Woodcote area at an estimated cost of £700, for which a loan is to be applied for, as against £4,000 for changing over.

LOAN.—The Council has also applied for a loan of £15,000 for switchgear, transformers, and cables in connection with the supply to the L.C.C. mental hospitals.

Erith.—LOAN.—The Urban District Council has applied for sanction to a loan of £10,000 for over-expenditure in connection with the electricity undertaking. A further sum of £5,000 will be required for mains extensions.

Exeter.—NO CONTRIBUTION TO RATES.—The City Council last Friday rejected a motion that the Electricity Committee should make a contribution of £2,000 towards the general rate. During discussion it was stated that the present outstanding debt on the undertaking amounted to £358,000, but that the undertaking was probably a great deal better off than it was a year ago. In opposition, it was urged that consumers should be considered, and that if a large profit was made the price of electricity should be reduced.

Finchley.—MAINS EXTENSION.—The Electricity Committee is to extend mains at a cost of £800.

Glasgow.—DISTRIBUTING MAINS.—The Electricity Committee has decided to lay distributing mains at a cost of £23,287, including additional cables, section pillars, &c., required to complete the Shettleston and Tollcross scheme (£11,367), and

the Anderston district (cables to and from new sub-station and for change-over and distribution purposes) (£10,297).

PROGRESS DURING JANUARY.—Under the assisted-wiring scheme eighty-nine houses were wired in January, making the total to date 38,655, and hired appliances installed numbered eleven, making the total 17,538.

Hampshire.—ELECTRICITY FOR SANATORIUM.—The County Council is to install electricity at the Bishopstoke Sanatorium at a cost of £690.

Hornsey.—DEVELOPMENT.—In order to be able to cope with the building development in the district, the electricity department is to erect a sub-station at Highgate, costing £16,393, and extra plant is to be incorporated in the generating station at a cost of £3,490.

REDUCED CHARGES.—The Town Council has decided to make the following reductions in the charges for electricity: Domestic power rate—winter "unit" charge to be reduced from ¾d. to ½d.; picture theatres—price to be reduced by 10 per cent. on condition that the whole supply is taken from the Council; public lighting—the charge to be reduced from 1⅜d. to 1¼d. per kWh; industrial maximum demand rate—the follow-on charge of ¾d. to be reduced to ⅝d.

Huddersfield.—NEW PLANT.—The Town Council has approved an outlay of £18,000 for a 10,000-kW alternator and £50,000 for mains and services.

Hull.—RURAL CHARGES REDUCED.—The Electricity Committee has decided to reduce prices in the boroughs of Beverley and Hedon, and the rural districts of Beverley, Skirlaugh, Sculcoates, and Patrington, from 40 per cent. to 30 per cent. more than the prices for the time being charged for corresponding supplies within the city.

The Housing Committee has approved a suggestion by the city architect that in future where additional 5- or 15-A plugs are required in Corporation houses the tenants shall be allowed to have the plugs installed as they require by an approved electrical contractor in accordance with the city architect's specification, the whole cost being borne by tenants.

Lancaster.—LOAN.—The Electricity Committee is making an application for sanction to borrow £69,700 for a further scheme of rural area extensions.

Linton.—SUPPLY EXTENSION.—The Rural District Council has approved of plans submitted by the Beds, Cambs & Hunts Electricity Co. for extending the supply of electricity to Linton by overhead lines.

Llandegai.—SUPPLY INAUGURATED.—The village of Llandegai is now receiving a supply of electricity from Bangor, and almost every house has been connected.

London.—BERMONDSEY.—The Electricity Committee has decided that a consumer who has paid the hire charge for an iron for a period of five years shall be considered to have covered the cost of the iron and maintenance.

HAMMERSMITH.—The Electricity Committee recommends that the flat rate under tariff No. 2 (power, cooking, and heating) be reduced from 1½d. to 1d. per kWh, that the coal cost variation clause in tariff No. 3 be abolished, that the running charge of ¾d. per kWh in tariff No. 9 be reduced to ¾d., and that tariff No. 12 be abolished.

Manchester.—PROGRESS DURING DECEMBER.—The output during December (54,155,670 kWh) was a record; the substantial increase is largely accounted for by greater demands on the part of industrial consumers, whose consumption showed an advance of 18 per cent. on that of December, 1932. The Electricity Committee has decided to reduce the charges for self-contained water heaters. Applications for a supply of electricity numbered 1,599 from new consumers and 714 from existing consumers for additional supplies; the corresponding figures for the previous month were 2,026 and 1,023 respectively. Orders for hired cookers numbered 120, 238 new cookers being connected during the month, bringing the total on circuit to 12,363. Fourteen orders were received for washboilers and fourteen were connected, bringing the total to 577.

Midlands.—REDUCED CHARGES.—The Midland Electric Corporation for Power Distribution, Ltd., has reduced its charges. From January an additional discount of 5 per cent. is being allowed on the standard tariff, making a total discount of 15 per cent., and the charge to prepayment consumers has been reduced from 5d. to 4¾d. per kWh as from October 1st last.

Milton Regis.—SUPPLY EXTENSION.—The Rural District Council has raised no objection to the Kent Electric Power Co., Ltd., extending its supply to Upchurch by means of overhead lines.

Newcastle-under-Lyme.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order for the supply of electricity by the Newcastle-under-Lyme undertaking to Wolstanton United, Clayton and Keele.

North Wales.—REDUCED CHARGES.—The Electricity Distribution of North Wales and District, Ltd., has reduced the lighting flat rate from 8d. to 7d. per kWh. The heating and cooking flat rate has also been reduced from 3½d. to 3d. per kWh for the first 50 kWh taken each quarter. Consumers who are on the residential tariff are to receive a 20 per cent. reduction on the quarterly charge per room. The company now offers the use of an electric cooker free of all rental and installation charges.

Paignton.—SUB-STATION.—The Paignton Electric Light and Power Co., Ltd., is to erect a transformer sub-station in Keysfield Road.

Penrith.—SUB-STATION.—The Penrith Electric Co. is to erect a sub-station in Nicholson Lane, Penrith, and carry out a number of cable extensions.

Peterborough.—SUPPLY EXTENSION.—The Town Council has applied for a loan of £4,410 to enable it to give a supply of electricity to the London Brick Co. & Forders, Ltd., Norman Cross.

Plymouth.—REDUCED CHARGES.—The Electricity Committee has modified its charges as follows: For tramway purposes, from 0.855d. to 0.8d. per kWh; ordinary lighting, from 3½d. less 10 per cent. to 3d. per kWh; contractors' showrooms, from 1½d., less 10 per cent. to 1¼d. per kWh; illuminated signs, from 2½d., less 10 per cent., to 2d. per kWh; rebate and after-hours shop-window rate, from 2d., less 10 per cent., to 1½d. per kWh. For power consumers the discount is increased from 10 to 15 per cent.; the kW charge in contracts for power purposes is altered from yearly to quarterly assessment, and the minimum fixed charge under the optional "all-in" tariff is reduced from £2 to £1 12s. per annum.

Saffron Walden.—SPECIAL ORDER.—The County of London Electric Supply Co., Ltd., is to apply for a Special Order to empower the Saffron Walden Corporation to sell, and the company to purchase, the Corporation's undertaking.

Salford.—SUB-STATION.—The Electricity Committee has purchased a site in Simister Lane, Prestwick, for the erection of a sub-station.

Sheffield.—LOAN.—The Electricity Commissioners have sanctioned the borrowing of £36,778 for mains and £32,160 for transformers, switchgear, &c.

Silverdale.—SUPPLY INAUGURATED.—A supply of electricity has been provided for the district by the Westmorland & District Electric Supply Co., Ltd.

Russia.—THE "SVIRSTROI" UNDERTAKING.—According to a report in the German Press, difficulties are being experienced in connection with the new electric power station "Svirstroi" on the River Svir. Complications in relation to the site caused delay in the completion of the dam and in the erection of one of the generating sets. The power station comprises six Kaplan turbines, four of 37,500 h.p., two of 3,350 h.p. Three of the large machines were supplied by the Karlstads Engineering Works, and the fourth, as well as the small sets, was constructed at the "Stalin" works at Leningrad. The generators were also built in Leningrad, at the "Elektrosila" works. The Sewerny cable works at Leningrad (formerly the Vereinigte Kabel-Werke A.G.) supplied the cable for the 250-km. h.p. transmission. The whole station, after completion, is intended to produce 510 million kWh annually. Experimental running of the three large Swedish turbines was started last Christmas, and in the middle of January the machine which had been built in Leningrad to the same design was started up. It is reported that a number of troubles developed after the first few days of running and that at the end of a week a bad breakdown occurred, which was ascribed to defects in the control apparatus and oil distribution. As the small turbines supplied from Leningrad also caused difficulties, the whole load had to be taken by the Swedish plant. The Soviet Press is now demanding an inquiry into the technical qualifications of the station staff.

Tanfield (Durham).—LOAN SANCTIONED.—The Urban District Council has received sanction from the Electricity Commissioners to borrow £629 for overhead lines at White-le-Head.

Tynemouth.—SUB-STATION.—The Electricity Committee is to erect a sub-station on the Ridges Estate.

Wallasey.—CHEAPER ELECTRICITY.—The charge for lighting is to be reduced from 3¾d. to 3½d. per kWh, and that for advertising or restricted-hour lighting from 1¼d. to 1¼d. The reduction represents a concession of £7,000 per year.

NEW CHIMNEY.—The Electricity Department is to borrow £7,200 with which to build a new chimney at the Poulton generating station. Trouble has been experienced in the past owing to the emission of fumes and grit arising from the use of pulverised fuel. It is believed that the new chimney will overcome this trouble.

Walton and Weybridge.—SUPPLY EXTENSION.—The Urban District Council proposes to give a supply of electricity to the Silvermere Estate.

West Hartlepool.—INQUIRY.—Mr. T. L. Patterson, Ministry of Transport Inspector, held an inquiry at West Hartlepool on Friday into an application by the North-Eastern Electric Supply Co. for power to erect overhead wires in the vicinity of Seaton Carew station, and, after taking evidence, stated that he would view the area before submitting his report to the Ministry.

Wimbledon.—LOAN.—The Electricity Committee has obtained sanction to borrow £40,000 for mains and services and £9,814 for the provision of wiring installations.

York.—LOANS.—The Electricity Committee is seeking sanction to borrow £33,000 for mains and £1,000 for meters. Sanction has been received to the borrowing of £5,212 for mains and £384 for plant.

Traction

Algeria.—A DIESEL-ELECTRIC LOCOMOTIVE.—The Société Alsthom of Paris has recently completed an interesting Diesel-electric locomotive for use on the Algiers-Oran line of the P.L.M. Railway Co. It is capable of running about 625 miles without need for taking in fresh supplies of oil and cooling water, and of reliable operation in a climatic temperature often exceeding 120 deg. F. when travelling through sandy districts. The M.A.N. Diesel six-cylinder engine, built under licence in France, is of 920 h.p. at 700 r.p.m. A regulator is provided whereby under favourable conditions the engine speed may be cut down to 600 r.p.m. and to 400 r.p.m. for "idling" when the train is stopped. The engine is directly connected to a six-pole 870-A dynamo, generating at 670 V; it also drives through gearing at 2,080 r.p.m., a 155-V, 550-A generator supplying current for driving the radiator fans and engine accessories, and a 105-A 60-V exciter. A 64-cell battery of accumulators is also installed to operate the various controls and for lighting. The locomotive is mounted on six central wheels 4.1 ft. in diameter and two four-wheel bogies. The length over buffers is 49 ft. 7 in., the body is of steel construction, and the total weight in running order is about 100 tons. On trial a non-stop run of about 540 miles was made between Paris and Marseilles in nine hours, equal to an average speed of 60 m.p.h., a maximum of 75 m.p.h. being attained on certain stretches; the fuel consumption worked out at 4.57 lb. per mile.

Blackpool.—TRAMWAYS PROFIT.—The Transport Department announces a profit on the past year's working of £54,436, which is £27,737 more than was estimated.

Egypt.—RAILWAY ELECTRIFICATION.—The long-deferred project of electrifying the Cairo-Helouan suburban railway is again being considered. In the Egyptian budget there appears an item of £E10,000 for certain preliminary expenses in connection with the scheme. At the same time, a report is current in Cairo to the effect that the Egyptian Government Railways are negotiating with the Cairo Tramways Company on the lines that the latter shall undertake the electrification of the railway and operate it for a certain time, subject to the Government having the right to resume control of the section in due course.

Italy.—MILAN'S TRAMWAYS.—One of the most important tramway centres in Italy is the city of Milan, where the track length increased from 119 km. in 1917 to 271 km. in 1933. About 300 new cars have been built with a larger passenger-carrying capacity, and 500 new double-bogie cars of American type which, though shorter in length than two of the ordinary old cars, can carry the same number of passengers and occupy less room in the street. Speed has been increased, which has made it possible to carry 380 million passengers yearly. For the new traffic which may be created in zones distant from the main lines, other types of traction of more economical operation will have to be employed. Reports compiled by Ing. Franceschini, general manager of the Milan Tramways Corporation, contain a comparative study of the costs of the various systems of urban traction, trolley-bus, benzine autobus, oil autobus, electric trains, steam trains, &c., which discloses that for a daily average of 150 km. up to a frequency of four minutes and a half the electric tramway offers the greatest advantages, while with a frequency varying from 4.30 to 8 minutes the trolley-bus is to be preferred, and for a frequency of over 8 minutes a lower cost is shown by the oil autobus. The benzine autobus begins to show an advantage when the car frequency is 14 minutes. In Rome autobus services have replaced practically entirely the tramway services in the central part of the town. The building of underground systems in Rome and in Genoa is being seriously considered.

London.—SOUTHERN RAILWAY.—The success of the extensions of the electrified lines was emphasised by Mr. G. W. E. Loder (chairman) at the annual meeting of the Southern Railway Company held on March 1st. He stated that the expansion in revenue from passenger-train traffic during 1933 was very welcome. Of the increase of £321,000, no less than £150,000 was earned by the new electric services which began to operate on January 1st, 1933, when the extension of the electrification of the railway from Three Bridges to Brighton and Worthing was brought into use. During the year the number of passengers carried between London and Brighton alone increased by 520,000, and altogether they carried 2,213,000 more passengers in the newly electrified area, an advance of no less than 23 per cent. The improvement in traffic still continued, and in January last they carried 110,000 more passengers in this particular area than in the corresponding month of last year. The board felt justified in extending the electrification to Seaford, Eastbourne and Hastings, *via* Lewes, and there was every reason to hope for similar good results from this extension. The extension of the electrification from Bickley and Orpington to Sevenoaks was mentioned in the company's report.

Communications

European Broadcasting.—THE LUCERNE PLAN AGAIN.—An experimental table of long wavelengths has been adopted by the technical experts of the International Broadcasting Union who have been sitting in conference at Geneva since last month, says *Reuter*. The new table takes into account wavelengths attributed by the Lucerne Plan on the one hand and on the other the requirements of countries which signed, as well as those which did not sign, the Lucerne Plan. The conference ended on March 2nd, and will meet again in London from June 12th to June 20th. The experts, according to a communiqué issued last week, also discussed the attitude which will be taken up by the International Broadcasting Union at the wireless conference to be held in Lisbon in September with regard to such questions as beam transmission, synchronised stations, separation of frequencies and the elimination of industrial atmospherics. The Juridical Sub-committee discussed also the question of copyright in broadcasts and a possible revision of the international convention.

Finland.—TELEPHONY.—It is announced that the L.M. Ericsson Company, which owns 43 per cent. of the shares in the Finnish Southern Telephone Company, has made a definite offer to sell them to the Finnish Government. The Minister of Communications intends to lay before the Riksdag a proposal to buy the shares, which are offered on long-term credit arranged through the Stockholm Enskilda Bank.

Great Britain.—RADIO RELAY SERVICES.—The Bridlington Town Council has decided to enter into an agreement with Ellis (Bridlington), Ltd., for the establishment of a relay service. The Dudley General Purposes Committee has had further correspondence regarding the establishment of wireless relay services in the town, but has confirmed its previous decision that no action should be taken.

Poland.—NEW POZNAN STATION.—The Polish broadcasting station at Poznán has recently been reconstructed and is now working with an unmodulated aerial input of 16 kW. The wavelength allotted in accordance with the Lucerne Plan is 345.6 metres. The new crystal drive was completely erected, connected up, and ready for operation within four hours of the delivery of its packing cases at Poznán.

Proposed Manchester Transport Board

THE General Committee of the Manchester Corporation has given full consideration to the proposals for the formation of a Joint Transport Board, and recommends the City Council to approve the scheme.

The proposal to form a Joint Municipal Passenger Transport Board originated as a result of a resolution adopted by the Oldham Tramways Committee. The transport authorities concerned are Ashton-under-Lyne, Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stalybridge, the Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board, and Stockport. Leigh and Wigan have taken part in the consideration of the proposals, but it is not intended that they shall be constituent members of the Board. It is, however, suggested that the Bill constituting the Board should provide for other authorities to become members by agreement subsequent to the date of its constitution.

The proposed Joint Board is confined to municipal undertakings, but the present inter-running arrangements with private companies would continue, and it may be assumed that these arrangements would be simplified if they were made between a Joint Board and companies instead of several municipal undertakings.

The following brief particulars are given in relation to the nine undertakings concerned:—Capital expended, £10,046,490; outstanding debt, £4,138,289; reserve and renewals fund, £416,348; total revenue, £4,156,658; balance carried to net revenue, £768,258; surplus after net revenue charges, £112,936; total number of employés (at March 31st, 1931), 13,607.

The main reason for the Joint Board is to eliminate the present arbitrary transport boundaries with a view to meeting the convenience of passengers in the greater area which the Board would cover. At present, as it is pointed out in the report of the general managers, everything is in duplicate.

Other reasons for the Joint Board are given in the report of the general managers, which is signed by the manager of each of the nine undertakings covered by the proposals, and also of the Wigan and Leigh undertakings. It is generally accepted that by merging the nine separate undertakings into one undertaking as proposed considerable savings and economies would be achieved, notwithstanding increased costs which might be expected under the following heads: (i) the levelling up of wages of the operating staffs; (ii) the extension of superannuation provisions to employés who do not at present enjoy them.

The total revenue of Manchester is £2,176,252, and the total of the joint undertakings is £4,156,658. Manchester therefore earns approximately half of the total. With regard to fares it may be assumed that in case of amalgamation all fares could not at once be put on the same basis, although they would be at a later date.

The authorities concerned are in the first place now asked to say whether or not they approve of the principle of the Joint Board. If the principle is accepted a scheme will be prepared to form the basis of a Parliamentary Bill.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Anstruther.—March 13th. Commissioners of H.M. Works. Alterations and additions at Post Office and telephone exchange. Particulars from Architect, Office of Works, 122, George Street, Edinburgh (£1 1s.); tenders to Secretary, Office of Works, Storey's Gate, S.W.1.

Australia.—PERTH.—April 19th. Western Australian Government Electricity Supply. Boiler house equipment, one 25,000-kW turbo-alternator and e.h.p. and l.p. switchgear. (February 2nd.)

Bristol.—March 16th. Baths Committee. Electrical heating plant, &c., at Shirehampton Baths. (February 23rd.)

Cholsey (BERKS).—March 10th. Berks Mental Hospital Committee. Electric lighting and accessory works, &c., at the new villa for females. (February 16th.)

Croydon.—March 27th. Electricity Department. Extension to boiler house and installation of one boiler. (See this issue.)

Egypt.—CAIRO.—March 17th. Ministry of Public Works. One d.c. 110-V 3-kW generating set. (A.Y. 12232.)*

March 31st. One 25-kW self-contained lighting set. (A.Y. 12246.)*

Exminster.—March 17th. Committee of the Devon Mental Hospital. Electric lamps, &c., for six months from April 3rd. Tenders to C. Masters at the Hospital.

Fife.—March 12th. County Council. Various works, including electric lighting, at thirty-two houses at Torryburn. Specifications from J. Fraser & Son, architects, 3, Randolph Street, Dunfermline; tenders to J. M. Mitchell, county clerk, Cupar.

March 13th. Various works, including electric lighting, at thirty-two houses at Cardenden and forty at Loanhead. Schedules from G. B. Deas, Central Chambers, Kirkcaldy; tenders to J. M. Mitchell, county clerk, Cupar.

Halifax.—March 17th. Highways Committee. Traffic signals. (See this issue.)

Hull.—March 27th. Telephone Committee. Automatic telephone exchange. (February 9th.)

India.—TRAVANCORE.—May 7th. Government Electricity Department. Turbines, generators, switchgear, transformers, &c., for the Pallivasol hydro-electric scheme. (February 9th.)

NEW DELHI.—March 22nd. Stores Department. Insulated cables for twelve months from July 1st. (A.Y. 12254.)*

Leeds.—March 14th. Electricity Department. Stores for half-year ending September 30th, 1934, or, alternatively, during the year ending March 31st, 1935. (March 2nd.)

London.—FULHAM.—March 28th. Borough Council. Two 75,000-kVA and two 750-kVA transformers, an electric travelling crane and three electric and five hand-operated hoist-blocks. (March 2nd.)

GREAT WESTERN RAILWAY.—April 5th. Electrical wires, cables, lamps, &c. (See this issue.)

New Zealand.—WELLINGTON.—Posts and Telegraphs Department. April 18th. 1,000 switchboard plugs and 2,500 24-V switchboard lamps. (A.Y. 12218.)*

April 30th. Eighteen double-pole, single-throw contactors. (A.Y. 12250.)*

Public Works Department. May 8th. 6-V secondary batteries. (A.Y. 12244.)*

May 1st. Transformer oil drying and testing apparatus. (A.Y. 12252.)*

May 22nd. Battery-charging equipment. (A.Y. 12249.)*

June 5th. 50-V storage battery and charging equipment. (A.Y. 12245.)*

Northern Ireland.—BELFAST.—March 20th. Tramways Committee. Fifty tramcars: bodies, trucks, electrical equipment and spares. Town Clerk (deposit £2 2s.).

March 19th. Mental Hospital Board. Electrical fittings supplies for year ending March 31st, 1935. J. Harper, Secretary, Saintfield Road, Belfast.

April 6th. Electricity Department. Transformers and e.h.p. switchgear. (See this issue.)

Portsmouth.—March 20th. Electricity Department. Substation e.h.p. and l.p. switchgear and steel kiosks with switchgear. (See this issue.)

Rhondda.—March 24th. Electricity Department. Meters, copper wire, joint boxes, &c., for year ending March 31st, 1935. (February 23rd.)

South Africa.—JOHANNESBURG.—Railways and Harbours. March 26th. Six electric capstans for Port Elizabeth harbour. (A.Y. 12221.)*

Municipality. March 17th. Two ten-unit metal-clad type switchboards consisting of two units each of 500 A and eight units each of 300 A complete with all accessories. (A.Y. 12242.)* 3,000 pin insulators, 2,000 "M" shackle insulators, and 3,000 "N" shackle insulators. (A.Y. 12241.)*

CAPE TOWN.—March 28th. Electricity Department. Overhead line material. (A.Y. 12261.)*

Stoke-on-Trent.—March 12th. N.W. Midlands J.E.A. Transformers, e.h.p. and l.p. overhead transmission lines. (February 9th.)

Stornoway.—March 24. Town Council. Various works, including electric lighting, at housing scheme. Specifications, &c., from Burgh Surveyor, Municipal Buildings; tenders to Town Clerk.

Swansea.—March 19th. Electricity Department. One 20,000-kVA, 33,000/6,060-V transformer and sundry smaller transformers. (February 23rd.)

Tranent.—March 26th. East Lothian County Council. Various works, including electric lighting and heating installation, at additions and alterations to infant school. Particulars from County Architect, Property and Works Department, Haddington; schedules from R. and A. K. Smith, surveyors, 4, Forres Street, Edinburgh; tenders to G. Cruickshank, County Clerk, County Buildings, Haddington.

Uruguay.—MONTEVIDEO.—State Electricity Supply and Telephone Administration. April 2nd. 10,000 delta porcelain insulators and overhead transmission lines. (A.Y. 12227.)*

Whitby.—March 22nd. U.D.C. Electrical materials for year ending March 31st, 1935. (See this issue.)

Workington.—March 28th. Borough Council. Transformers, switchgear, l.p. distribution board, underground link boxes and feeder pillars. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Barking.—Education Committee. Recommended. Electrical installation at Bifrons school (£986).—Davis Myer & Co., Ltd.

Birkenhead.—Cemetery Committee. Accepted. Electric lighting at Landican cemetery buildings (£250).—S. George.

Electricity Committee. Accepted. Wiring houses under assisted scheme. Seven (£32).—L. W. Bryan; forty-one (£176).—Economic Electric Co.; fifty-three (£244).—Park Electric Co.; thirty-six (£170).—J. J. Peters; four (£19).—W. H. Trace & Son.

Eccles.—Housing Committee. Accepted. Electric wiring and fittings for 104 houses (£399).—J. E. Walton.

Electricity Committee. Accepted. 150-kVA transformer (£121) and 250-kVA transformer (£163).—Electric Construction Co., Ltd.

Glasgow.—Housing Committee. Accepted. Electrical installation at the Blackhill re-housing estate (£2,228).—A. A. Moore. Electrical installation at forty-eight houses at Elmvale Road (£184).—J. Edward.

Public Assistance Sub-Committee. Recommended. Electrical work in connection with new buildings at Lennox Castle Institution.—J. Kilpatrick & Son, Ltd. (£17,678); Derby Cables, Ltd. (£17,404).

Transport Committee. Accepted. Three 1,500-kW rotary converters with Bruce Peebles transformers.—Harland Engineering Co., Ltd. One 2,000-kW rotary converter with transformer and switchgear.—Electric Construction Co., Ltd. Signalling equipment spares.—Westinghouse Brake and Saxby Signal Co., Ltd.

Guildford.—Watch Committee. Accepted. Traffic signals (£447).—Automatic Electric Co., Ltd.

Halifax.—Town Council. Accepted. Installing electric lighting at maisonettes in King Cross Street (£132).—J. Harrison & Co. Installing electric lighting at twenty-six houses on the Ovenden Hall estate (£99).—W. Wright.

Herne Bay.—General Purposes Committee. Recommended. Internal electric lighting system at Grand Pavilion (£378).—Falk, Stadelmann & Co., Ltd. Electric tramcar and conversion of car to trailer (£1,049).—F. C. Hibberd & Co., Ltd.

Kenilworth.—Urban Council. Accepted. Centrifugal pump, with electric motor, for the waterworks.—Mather & Platt, Ltd.

Leeds.—Transport Committee. Accepted. Sixteen four-motor tramcar electrical equipments (£13,848).—General Electric Co., Ltd.

Electricity Committee. Accepted. Cables: W. T. Henley's Tel. Works Co., Ltd. (£409); Edison Swan Cables, Ltd. (£959); Hackbridge Cable Co., Ltd. (£592); Metropolitan Electric Cable & Construction Co., Ltd. (£197).

Health Committee. Accepted. Food-mixing machine (£179).—Peerless Electrical Mfg. Co., Ltd.

London.—L.C.C. Recommended. Electric lighting and power installation at Middle Park School (£646).—Read & Partners, Ltd.

LEWISHAM.—General Purposes Committee. Recommended. Electric lighting at Springfield Park Crescent market (£99).—A. J. Hewens & Sons.

HAMMERSMITH.—Electricity Committee. Recommended. Switchboard (£721).—J. G. Statter & Co., Ltd.

Manchester.—Health Committee. Accepted. Automatic telephone installation at Langho colony.—A. E. Sudlow & Co., Ltd. Internal telephone installation at Withington institution.—New Era Time & Telephone Systems, Ltd.

Education Committee. Accepted. Electrical installation at York Street centre.—R. Seddon & Sons, Ltd. Electrical improvements: Moseley Road School.—J. Collier & Co., Ltd.; Lloyd Street School.—R. Seddon & Sons.

Electricity Committee. Accepted. Electric cookers for twelve months.—Simplex Electric Co., Ltd.; General Electric Co., Ltd.; Revo Electric Co., Ltd. Street lighting columns for six months.—Bromford Tube Co., Ltd.; British Mannesmann Tube Co., Ltd. Gaseous discharge lamps and lanterns.—General Electric Co., Ltd. 33,000-V feeder cable.—Callender's Cable & Construction Co., Ltd. Economisers at Barton and Stuart Street power stations.—E. Green & Son, Ltd.

Highways Committee. Accepted. Traffic signals at three junctions.—Forest City Electric Co., Ltd.

Northern Ireland.—BELFAST.—Electricity Committee. Accepted. Stores for year ending March 31st, 1935: Cables and fuses.—Siemens Bros. Lamps, time switches and transformer kiosks with h.p. and l.p. switchgear.—General Electric Co., Ltd. Kettles.—Revo Electric Co., Ltd. Meters and instrument transformers.—Chamberlain & Hookham, Ltd. Maximum demand indicators.—Reason Manufacturing Co., Ltd. Cut-outs.—W. Lucy & Co., Ltd. H.p. and l.p. cables, telephone cables, telephone boxes.—W. T. Henley's Telegraph Works Co., Ltd.

Tramways Committee. Accepted. Stores for year ending March 31st, 1935: Electrical accessories.—Siemens Electric Lamps & Supplies, Ltd.; L. Andrew & Co.; General Electric

Co., Ltd. Cables.—General Electric Co., Ltd.; Johnson & Phillips, Ltd.; British Insulated Cables, Ltd. Armature and field coils.—Manchester Armature Repair, Co. Cadmium-copper trolley wire.—British Insulated Cables, Ltd.

Paisley.—Town Council. Accepted. Electrical work at new hospital at Hawkhead (£5,950).—J. Kilpatrick & Son, Ltd.

Plymouth.—Electricity Committee. Accepted. E.h.p. switchgear.—A. Reyrolle & Co., Ltd.; General Electric Co., Ltd. L.p. switchgear.—General Electric Co., Ltd. L.p. cables.—British Insulated Cables, Ltd. H.p. and e.h.p. cables.—Metropolitan Electric Cable Co. Transformers and time switches.—General Electric Co., Ltd. Meters.—Ferranti, Ltd.; Chamberlain and Hookham; Metropolitan-Vickers Electrical Co., Ltd.

Ramsgate.—Town Council. Accepted. Electrical illumination of the sea front (£581).—J. Carman.

Salford.—Electricity Committee. Recommended. Repairing storage battery at Agecroft power station (£1,800).—Chloride Electrical Storage Co., Ltd.

Stratford-on-Avon.—Rural Council. Accepted. Wiring for electric lighting in twenty-six houses at Wellesbourne (£3 per house).—D. H. Gittins & Co.

Smethwick.—Watch Committee. Accepted. Traffic signals at Cape Hill (£593).—Automatic Electric Co., Ltd.

Wimbledon.—Electricity Committee. Accepted. Oil circuit-breakers for power station (£1,400).—Ferguson, Pailin, Ltd. Switching equipment for sub-stations (£1,752).—English Electric Co., Ltd. Transformers. Four 1,000 kVA (£1,860).—Foster Engineering Co.; twelve 200 kVA (£1,260).—Hackbridge Electric Transformer Co.; five 200 kVA (£525).—C. A. Parsons & Co., Ltd. Thrust borer (£265).—Hydraulic Engineering Co.

Forthcoming Events

Birmingham Electric Club.—Friday, March 9th. Annual dinner.

Junior Institution of Engineers.—Friday, March 9th. Institution, London, 7.30 p.m. "Power Plant Pipework." Mr. A. G. Bugden. Friday, March 16th. 7.30 p.m. "Totalisators." Mr. J. H. Broome.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, March 10th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Colliery Engineering." Mr. W. J. Tanner.

Institution of Electrical Engineers.—Monday, March 12th. Institution, London. 7 p.m. Informal meeting. Discussion on "Should Single-phase Networks be considered Obsolete?" Opened by Mr. W. A. Turnbull. Thursday, March 15th. 6 p.m. Faraday lecture, "The Electrical Engineer and Free Electron." Mr. C. C. Paterson. (*North-Eastern Students' Section*).—Friday, March 9th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "The Development of Current and Voltage Transformers." Mr. J. W. Bayles. Saturday, March 17th. Visit to works of Messrs. C. A. Parsons & Co., Newcastle-on-Tyne. (*North Midland Centre*).—Friday, March 9th. Hotel Metropole, Leeds. 7.30 p.m. Annual dinner. (*London Students' Section*).—Saturday, March 10th. 2.30 p.m. Visit to the Battersea power station. Wednesday, March 14th. 1.20 p.m. Visit to the works of the Cement Marketing Co., Greenhithe. (*Mersey and North Wales (Liverpool) Centre*).—Monday, March 12th. University, Liverpool. 7 p.m. Short papers. Wednesday, March 14th. Temple, Liverpool. 6.30 p.m. Joint meeting with the Liverpool Engineering Society. "Electric Propulsion for Ships." Mr. E. M. Johnson. (*North-Eastern Section*).—Monday, March 12th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Some Problems of Rural Electrification." Mr. R. M. Charley. (*North Midland Students' Section*).—Tuesday, March 13th. Hotel Metropole, Leeds. 7.15 p.m. "Some Developments in Railway Signalling." Mr. R. O. Yardley. (*North-Western Students' Section*).—Tuesday, March 13th. Engineers' Club, Manchester. 7.15 p.m. "Over Voltages and their Influence on Transmission System Design." Mr. J. E. L. Robinson. (*Scottish Centre*).—Tuesday, March 13th. North British Station Hotel, Edinburgh. 7 p.m. "Grid Metering." Mr. J. Henderson. (*Western Centre*).—Tuesday, March 13th. Town Hall, Newport. 7.30 p.m. Faraday lecture. "The Electrical Engineer and the Free Electron." Mr. C. C. Paterson. (*Hampshire Sub-Centre*).—Wednesday, March 14th. University College, Southampton. 7.30 p.m. Short papers. (*Irish Centre*).—Thursday, March 15th. Trinity College, Dublin. 7.45 p.m. Lecture on "Electric Thermal Storage in the Irish Free State." Mr. E. M. Ackery. (*Scottish Students' Section*).—Thursday, March 15th. Royal Technical College, Glasgow. 7.30 p.m. Annual meeting. "Letters Patent for Inventions." Mr. H. J. Fitzpatrick. (*Meter and Instrument Section*).—Friday, March 16th. Institution, London. 7 p.m. Informal discussions.

Institute of Transport.—Monday, March 12th. Institution of Electrical Engineers, London. 5.30 p.m. "Railway Colour Light Signalling from an Operating Point of View." Mr. C. M. Jenkin Jones.

British Electrical Development Association (*South Wales Area*).—Tuesday, March 13th. Royal Hotel, Bristol. Annual meeting and luncheon. (*Northern Counties Area*).—Friday, March 16th. Grand Assembly Rooms, Newcastle-on-Tyne. Annual meeting and luncheon.

Illuminating Engineering Society.—Tuesday, March 13th. Lighting Service Bureau, W.C.2. 6.30 p.m. "The Æsthetics of Electric Lighting in Architecture." Mr. R. O. Sutherland.

Institute of Marine Engineers.—Tuesday, March 13th. Minories, E.C.3. 6 p.m. "Alternating Current for Ships' Auxiliary Machinery." Mr. W. J. Belsey.

Electrical Industries Benevolent Association (*South Coast Branch*).—Friday, March 16th. Grand Hotel, Brighton. Dance.

Institution of Mechanical Engineers.—Friday, March 16th. Storey's Gate, S.W.1. 6 p.m. "Mechanics of Electrical Switchgear." Mr. H. Trencham.

Physical Society.—Friday, March 16th. Imperial College of Science and Technology, S.W.7. 5 p.m. Annual meeting.

Notes

A Combined Water Power and Diesel Plant

Downton, Wiltshire, is some distance from any power network, so that the question of supply from the grid does not arise. Some years ago the Southern Tanning Co., the principal power user in the village, installed a Robey oil engine to work in parallel with and as a standby for a water-wheel driven d.c. generator, and obtained its power from these sources. As the demand for electric lighting grew in the village, the original waterwheel-driven generator was superseded by an 85-kW Armfield-Brush water-turbine alternator which was used both to supply a.c. motors in the tannery and the village lighting. With a continually increasing lighting load, and a possible further industrial demand from other sources, it was decided to extend the plant, providing against shortage of water to the turbine in times of drought, and to give a greater supply of power to industrial users. A "Brush" four-cylinder opposed 160-h.p. Diesel engine driving a "Brush" alternator was therefore installed. The engine works either in parallel with the water turbine unit or as the sole source of power when the latter is shut down. The compactness of the Diesel unit will be noted from the illustration on page 343, and an interesting point is that although the photograph was a time exposure of about 30 seconds, there is no trace of vibration; in fact, the appearance of the flywheel is the only evidence that the engine is running.

The Electrical Association for Women

Sir John R. Brooke (vice-chairman, Electricity Commission) speaking at a luncheon on February 28th at the Grand Hotel, Birmingham, arranged by the Birmingham and Midlands Branch of the Association, said that in the last five years the domestic consumption in Birmingham had more than doubled. Whereas in the four years of depression the country's industrial load had only increased by 10 per cent., the domestic load had increased by 50 per cent., although this was not very much when compared with Birmingham's 100 per cent. Dame Ethel Shakespeare (president of the branch) was in the chair.

An Aberdeen branch of the Association was formed on March 2nd at a meeting in the Corporation electricity showrooms. Office-bearers were appointed as follows: President, the Countess of Southesk; vice-presidents, Lady Grant and Mrs. Irvine; secretary, Miss Botting; and treasurer, Miss Prosser.

The annual dinner of the Bradford branch took place on March 2nd, under the chairmanship of Mrs. W. G. Dawson. The Lord Mayor of Bradford (Capt. A. W. Brown) proposed the toast of the Association and Mrs. Gregory, vice-chairman of the branch, responded. The toast of the branch was proposed by Ald. J. W. Longley, chairman of the Corporation Electricity Committee, who said that if Bradford had not reduced charges during the last eighteen months or so the department could have shown £60,000 more profit this year. During the three years' existence of the branch electricity consumers in Bradford had increased from 31,500 to 42,000.

The first list of successful applicants for the Diploma in Electrical Housecraft for Teachers, which are to be awarded at the annual meeting of the Association in April, contains twenty-three names from all parts of the country, including two from London.

Public Lighting Engineers' Conference

The annual conference of the Association of Public Lighting Engineers is to be held in Aberdeen from September 7th to 20th.

Finsbury Old Students

The twenty-second dinner of the Finsbury Technical College Old Students' Association will be held on March 17th at the Trocadero Restaurant, W., when Mr. H. D. Symons, president of the Association, will preside. Tickets (10s. 6d. each) can be obtained from Mr. F. R. C. Rouse, hon. secretary, 15, Clifton Gardens, Golders Green, N.W.11, who will supply particulars to any old students who are not on the register.

Miners' Hand-lamp Bulbs

The new British Standard Specification for 4-V miners' hand-lamp bulbs for use with lead acid lamps provides for a mean spherical candle power of 1.91 (equivalent to a mean horizontal candle power of 2.4, as compared with 0.83 and 1.05 in the case of 2-V lamps). A comprehensive glossary of the standards, terms and definitions used is included, together with particulars of the necessary testing requirements. A Specification for 2.5-V miners' hand-lamp bulbs for use with the alkaline type of lamp is in an advanced stage, and it is hoped that this will be issued later in the year. Copies of this Specification (No. 535-1934) can be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

Appointments Vacant

Meter superintendent for Bath Electricity Department.

Meter repairer for Stoke-on-Trent Electrical Engineer's Department.

Chief technical assistant for Croydon Electricity Department.

(See our classified advertisements.)

Makers' Names Wanted

ALLINSON dough mixer.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. W. G. Bass, B.Sc., A.K.C., A.M.I.E.E., district sales manager in the London office of Messrs. Ferranti, Ltd., has been appointed B.E.A.M.A. delegate upon the British Trade Mission to Poland, to represent the electrical goods and apparatus industry. From 1909 to 1914 Mr. Bass was a workshop student at the Royal Arsenal, Woolwich, and after war service he joined the Cleveland & Durham Electric Power Co., Ltd., on the constructional engineer's staff. In 1921 he became assistant engineer in the electrical engineer's department of Messrs. Merz & McLellan at their Newcastle office, and left there in 1926 to join Messrs. Ferranti. He accompanied Mr. Allen West, B.E.A.M.A. delegate, on the British Trade Mission to Finland in February, 1933. He is hon. secretary of the North-Eastern Electric Supply Co. Old Employés' Association, whose annual dinner is being held on March 23rd, when Mr. R. P. Sloan, the president, will be in the chair. The mission left London on Tuesday last.

Mr. W. G. Bass

Mr. T. Walmsley has been awarded the degree of Ph.D. (external) in the Faculty of Engineering (telegraphy and telephony) by the Senate of the London University.

Mr. D. J. Bolton, M.Sc., M.I.E.E., the author of the article on "Charging for Power Factor" on page 336 of this issue, was educated at Nottingham High School and took a London degree as a student at University College, Nottingham. He served his apprenticeship with the Metropolitan-Vickers Co. at Trafford Park, and later was on the staff of this company, being with it for a total period of four years. He left Manchester for the Stafford works of the English Electric Co., and his subsequent experience on the manufacturing side included work on switch and control gear. He also served as a P. and O. "Batti-Wallah," visiting the Cape, Australia, and India. During the past fourteen years he has been a lecturer in electrical engineering at the Regent Street Polytechnic, where a somewhat novel course on electrical economics has been developed. He is also well known as the author of a number of books and articles on this subject, and as the inventor of several tariff-indicating devices.

Lord Rutherford and **Col. R. E. Crompton** have been elected honorary members of the Société Française des Electriciens.

Mr. F. J. Philips, son of Dr. A. F. Philips, founder of Philips Lamps, Ltd., speaking from Philips House, London, W.C.2, addressed an audience gathered at Sydney at the opening of the Australian Radio and Electrical Exhibition

Mr. F. J. Philips speaking from London to an audience at the Australian Radio and Electrical Exhibition, Sydney

on February 28th. Mr. A. den Hertog, chairman of the exhibition and managing director of Philips, Australasia, replied from Sydney *via* the Baldock receiving station. Our illustration shows Mr. Philips at the microphone.

Sir James Jeans was elected president of the British Association for the year, in succession to the late Sir William Hardy, at a general committee meeting of the Association held on March 2nd.

Mr. Arthur C. Hazel has resigned his appointment with the Ealing Electricity Department to take up the position of sales superintendent with the South Somerset and District Electric Co., Ltd., a subsidiary of the British Power and Light Corporation. Mr. Hazel has contributed several articles to this journal, including one on "The Male Demonstrator" (ELECTRICAL REVIEW, August 25th, 1933, page 258). His portrait appeared in that issue.

Mr. Samuel Ferguson, managing director of Messrs. Ferguson, Pailin, Ltd., of Higher Openshaw, Manchester, was married on March 1st to Miss Ruby C. Ashby, of London. Miss Ashby latterly held a position on the advisory staff of Messrs. Hodder & Stoughton, publishers. She holds an Oxford University honours degree in English language and literature, and is the author of several popular novels.

Mr. Ernest Arthur Mills, A.M.Inst.C.E., M.I.E.E., M.I.Mech.E., who has been borough electrical engineer and manager at Halifax for the past two years and eight months, was last week appointed borough electrical engineer at Hackney at £1,500 per annum, rising by £50 per annum to £2,000. He will succeed Mr. L. L. Robinson, who has had control of the undertaking from its inception and who is retiring, as stated in our issue of January 26th (page 139). The advertisement inviting applications for the appointment included as one of its conditions that applicants' age should not exceed forty-five years. Mr. Mills's age is forty-eight, and this departure from the terms of the advertisement gave rise to considerable discussion at last week's Council meeting.

[*Lafayette*

Mr. E. A. Mills

There were twenty-seven replies to the advertisement, and six of the applicants were interviewed. Ultimately, the particulars of qualifications, &c., of three, aged respectively forty-eight, thirty-seven, and forty-five years, were submitted to the Council, and the committee thought that Mr. Mills should be included, notwithstanding his age, on the grounds of his qualifications and experience. One councillor questioned the legality of his appointment, but the Mayor ruled that it was in order. The point was made that if the age limit had not been in the advertisement many men of forty-seven and forty-eight would have been glad to put in for the job and the Council should insist on the terms of the advertisement being carried out. It was ultimately stated that of the twenty-seven applicants six were over forty-five, and two of these were placed on the short list. When Mr. Mills came before the Council he said, in reply to questions, that it was often the case that candidates over the age limit applied for positions as they considered that greater experience might count. Asked as to the three months' notice that he would have to give at Halifax, he said that he could come to Hackney at once. He also said that he was prepared to guarantee at least a lengthened stay at Hackney. The end of the discussion saw Mr. Mills appointed with one dissentient, and the Mayor congratulated him on the result. Mr. Mills was with the Yorkshire Electric Power Co. for four years, a draughtsman with the B.T.-H. Co., engineering assistant to the North Metropolitan Electric Power Supply Co., assistant constructional engineer in Birmingham Electricity Department, chief assistant electrical engineer at Leeds, was for more than seven years in important engineering positions with the Shanghai Municipal Electricity Department, and for three years deputy electrical engineer and manager at Leicester, before going to Halifax.

Prof. F. G. Baily, Professor of Electrical Engineering, Edinburgh, has been nominated as chairman of the Scottish Centre of the Institution of Electrical Engineers to fill the vacancy which will occur on September 30th next.

Mr. J. F. H. Shaub is leaving the meter test and electrical laboratory of the British Thomson-Houston Co. (Willesden), where he has been for the past seven years, to take up an appointment in the Stoke Newington Council's meter department.

The Aerodromes Advisory Board.—This board has been formed under the chairmanship of Capt. F. E. Guest, M.P., to continue and expand on a wider basis preliminary investigations carried out during the past few years by the Aerodromes Committee of the Royal Institute of British Architects. The membership for 1934 has now been completed, and includes the following representatives appointed by various bodies: Institution of Electrical Engineers, Mr. P. V. Hunter (president) and Mr. C. C. Paterson (past-president); Association of Consulting Engineers, Mr. A. M. Sillar (chairman) and Col. J. D. K. Restler; Electricity Commission, Mr. T. P. Wilmshurst.

Mr. J. W. Hadfield, electrical engineer and manager of the Barnstaple Corporation electricity undertaking, has had his salary increased to £450, rising by two increments to £500.

Mr. A. J. Grose, formerly London manager of Electric Lamp Factors, Ltd. (in liquidation), has joined the new board of directors of the A.B. Electric Co., Ltd., and has taken over the management of the business.

Obituary

Mr. E. M. Duggan, M.Inst.C.E., official chairman of Karachi Port Trust, has died in Karachi at the age of fifty. While chairman of the Aden Settlement Executive Committee from 1919 to 1924, he organised the public supply of electricity.

Mr. Martin Catto, formerly chief inspector of the G.P.O. Engineering Department at Aberdeen, has died at the age of fifty-nine. At the time of his retirement last year he was in charge of the instrument room of the Aberdeen Post Office. He joined the service over forty-four years ago.

Will.—Mr. J. H. Bowden, late electrical engineer and manager to the Poplar Borough Council, left £4,510 (net personalty £3,263).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Hammonds Radio, Ltd.—Private company. Registered March 1st. Capital, £300 in £1 shares. Objects: To acquire the business of Hammonds Radio at Tottenham and elsewhere, and to carry on the business of importers and exporters of, agents for and wholesale and retail dealers in radio, television, and electrical apparatus, &c. The first director is S. Rich, 65, Lordship Road, N.16. Registered office: Bank Chambers, 130, Whitechapel High Street, E.1.

Hampshire Crystalite Co., Ltd.—Private company. Registered February 27th. Capital, £5,000 in 2,500 7½ per cent. cumulative preference and 2,500 ordinary shares of £1 each. Objects: To acquire the business of a dealer in electric lamps now carried on by G. R. Bennett, at 121/123, High Street, Portsmouth. The directors are: G. R. Bennett, 16, High Street, Portsmouth, and Major G. Combe, 10, South Parade, Southsea, Hants. Secretary: Jean Wild. Solicitors: Helland & Bechervaise, 132, High Street, Portsmouth.

Universal Lamp Co., Ltd.—Private company. Registered February 26th. Capital, £10,000 in £1 shares. Objects: To carry on the business of importers and exporters of electric and incandescent lamps, accessories, &c. The directors are: L. J. Myloski, 532, High Road, Tottenham, N., and I. Joseph, 46, Forburg Road, Stoke Newington, N. Registered office: 82, Great Eastern Street, E.C.2.

Western Electrical Power Co. (Liverpool), Ltd.—Private company. Registered February 28th. Capital, £600 in £1 shares Objects: To carry on the business of the installation, maintenance and repair of electric lighting, heating and power wiring, electrically driven motors, dynamos and machinery, &c. The directors are: W. M. Marsland (chairman), 6, Sundridge Street, Liverpool, and M. Tobin, 57, Bagot Street, Liverpool. Registered office: 78, Duke Street, Liverpool.

Tubelight Sales, Ltd.—Private company. Registered February 26th. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, dealers in electric incandescent filament lamps and all fittings, &c. The subscribers are: A. E. Ashwell, 53, Somerset Avenue, Hook, Surbiton, Surrey, and A. F. Chapman, 10, Morley Avenue, Wood Green, N.22, accountant. Secretary: A. Eickman. Registered office: 4, London Wall Avenue, E.C.2.

Pioneer Relay Services, Ltd.—Private company. Registered March 3rd. Capital, £350 in £1 shares. Objects: To acquire the business of relaying and transmitting broadcast music, speeches, &c., carried on by D. Trembath and T. Barnshaw at Frinton-on-Sea and other places. The directors are: D. Trembath and Mrs. Ethel A. Trembath, both of Manor House, Great Clacton, Essex; and T. Barnshaw, Holland Road, Clacton. Secretary: T. Barnshaw. Registered office: Marazion, Pole Barn Lane, Frintón-on-Sea.

Simlans, Ltd.—Private company. Registered March 2nd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio apparatus, engineers, &c. The directors are: J. S. Stower, 33, Paulton Square, S.W.3; J. C. A. Simson, Glencairn, Milford-on-Sea, Hants; and L. A. Notcutt, 142, Goldhurst Terrace, St. John's Wood, N.W.6. Secretary: J. S. Stower. Registered office: Sentinel House, Southampton Row, W.C.1.

Returns of Electrical Companies

General Resistors, Ltd.—The nominal capital has been increased by the addition of £3,000 beyond the registered capital of £5,000. The additional capital is divided into 1,500 5 per cent. cumulative preference and 1,500 ordinary shares of £1 each, ranking *pari passu* with existing shares.

Owens Battery Equipment, Ltd.—Particulars filed of registered notes to secure (including any premium which may become payable) not more than £10,500, authorised February 1st, 1934, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £7,000.

Shardlow Electric Wires, Ltd.—Debenture dated February 17th, 1934, to secure £2,000, charged on the company's property, present and future, including uncalled capital. Holder: L. S. Hargreaves, 83, Hulme Road, Cheadle Hulme, Ches.

Siemens Bros. & Co., Ltd.—Satisfaction to the extent of £41,600 on January 1st, 1934, of debenture stock secured by trust deed dated January 15th, 1918, and registered January 21st, 1918.

Vac-Tric, Ltd.—Satisfaction to the extent of £3,245 on October 25th, 1933, to the extent of £512 16s. 3d., on January 17th, 1934, and to the extent of the balance of £3,504 10s. 4d., on February 13th, 1934, of mortgage dated December 2nd, 1932, and registered December 5th, 1932.

J. W. Ray & Co. (Liverpool), Ltd.—Capital, £3,000 in £1 shares. Return dated October 3rd, 1933. 2,753 shares taken up. £2,753 paid. Mortgages and charges, nil.

Long & Carter, Ltd.—Capital, £1,300 in £1 shares. Return dated October 24th, 1933. 1,252 shares taken up. £752 paid, £500 considered as paid. Mortgages and charges, nil.

Brown & Co. (Electrical Engineers), Ltd.—Capital, £5,000 in £1 shares. Return dated October 18th, 1933. 4,529 shares taken up. £12 paid, £4,517 considered as paid. Mortgages and charges, nil.

Ricardo & Co. Engineers (1927), Ltd.—Capital, £21,000 in 20,000 cum. participating preference shares of £1 and 20,000 founders' shares of 1s. each. Return dated November 6th, 1933. All shares taken up. £2 paid, £20,998 considered as paid. Mortgages and charges, £3,000.

Leonard J. Ive, Ltd.—Capital, £1,000 in £1 shares. Return dated November 24th, 1933. 500 shares taken up. £500 paid. Mortgages and charges, £1,000.

William McGeoch & Co., Ltd.—Mortgage on freehold land and buildings in Coventry Road, Bordesley, Birmingham, known as Warwick Works, dated February 6th, 1934, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £11,500.

T. A. Beavon & Co., Ltd.—First debenture dated February 21st, 1934, to secure £4,500. Property charged: the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: Westminster Bank, Ltd.

Pioneer Private Telephone Co., Ltd.—The nominal capital has been increased by the addition of £5,000 beyond the registered capital of £1,500. The additional capital is divided into 5,000 7½ per cent. cumulative preference shares of £1 each.

Wakefield Relay Services, Ltd.—The nominal capital has been increased by the addition of £2,000 beyond the registered capital of £5,000. The additional capital is divided into 2,000 preference shares of £1 each.

Gwalia Radio Relay Service, Ltd.—The nominal capital has been increased by the addition of £16,250 beyond the registered capital of £10,000. The additional capital is divided into 15,000 8 per cent. participating preferred ordinary shares of £1 each and 25,000 deferred ordinary shares of 1s. each.

Victoria Electric Plant Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 22nd, 1933. 253 shares taken up. £253 paid. Mortgages and charges, £550.

Vactite Wire Company (1919), Ltd.—Capital, £25,000 in £1 shares. Return dated November 2nd, 1933. 15,000 shares taken up. £3 paid. £14,997 considered as paid. Indebtedness in respect of mortgages and charges at date of return, nil; since registered, debenture dated November 30th, 1933, to secure £1,000.

Stella Conduit Co., Ltd.—Capital, £20,000 in £1 shares. Return dated November 7th, 1933. All shares taken up. £20,000 considered as paid. Mortgages and charges, nil.

T. W. Broadbent, Ltd.—Capital, £5,000 in 440 5 per cent. preference and 560 ordinary shares of £5. Return dated November 3rd, 1933. All shares taken up. £35 paid. £4,965 considered as paid. Mortgages and charges, nil.

Kamm & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated January 11th, 1934. All shares taken up. £9,998 considered as paid. £2 calls unpaid. Mortgages and charges, £2,000.

City Notes

The Midland Counties Electric Supply Co., Ltd., held its annual meeting on March 5th, Mr. G. Balfour (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, March 2nd, page 329), the chairman said that the current year was the first in which they had employed petrol buses and trolley-buses, and they now operated on services over 550 route miles. The year's working provided a balance of

£51,180, of which £45,680 was applied to depreciation and £5,500 was left in reserve, only a small amount being brought into the accounts of the company so that the results shown in the accounts submitted were attributable to the electricity supply business. The earnings of the transport undertakings so far this year showed a considerable improvement compared with the corresponding period of last year. Turning to the electricity supply business, he said that the transmission lines of the Central Electricity Board would be connected to, and operated with, their three selected generating stations next month, but owing to their low operating costs they must not expect to benefit. The operating companies' power stations generated 268,638,000 kWh and, in addition, 10,519,000 kWh was purchased from other sources. The total sales were 236,531,000 kWh, an increase of 22,798,000 kWh over the previous year. In addition to three power stations, the electricity supply companies operated through 982 sub-stations, 133 being main substations, 231 secondary, and 618 kiosks or pole-type. They connected 11,352 new consumers during 1933, making the total now supplied 62,885. The number of consumers had been trebled during the last five years. An additional 21,149 kW was connected to their mains, making the total connected load 202,121, while the maximum demand, including 2,140 kW purchased, was 78,750 kW. During the year 113 miles of h.p. lines were laid or erected, making the total 1,309 miles, and 179 miles of l.p. distributors were installed, bringing the total to 1,242 miles. The total length of the lines now in use was 2,551 miles. Supplies were inaugurated in one urban district and fifty-nine parishes, and altogether the operating companies distributed electricity in three boroughs, thirty-one urban districts and 462 parishes. Arrangements were entered into for street lighting in two additional urban districts and eight parishes, and these street-lighting services were now provided in two boroughs, seventeen urban districts and ninety-four parishes. The average price per kWh for all supplies over the whole of their area was 0.9d. For the current year to date they were able to record a satisfactory increase in revenue, and with the growing recognition of electrical domestic service due to reliability of apparatus, there should be ample room for expansion.

The Chiswick Electric Supply Corporation, Ltd.—Presiding at the annual meeting held on February 28th, Mr. H. Kahn (chairman) said that they continued to make steady progress. The sales of electricity amounted to 5,274,946 kWh, an increase of approximately 9 per cent. as compared with the preceding year, and the number of consumers was 8,802, an increase of 6½ per cent. At Chiswick they had been working since January 1st, 1933, under a new agreement for the supply of electricity in bulk, and there was an annual saving of £5,000, which they had to distribute to the consumers; the amount was reserved in the revenue account. Though the Corporation did not directly benefit by the diminished cost it would benefit indirectly by the resultant additional sale of electricity. To meet increased demand an additional 1,000-kW motor-convertor was being installed. At Aberystwyth the output during the year had shown further expansion. A considerable amount had been spent in renewing mains and increasing their capacity, and additional generating machinery would be required shortly. The Chiswick local authority had given notice of its intention to purchase the Chiswick undertaking on July 25th next. This action on the part of the authority came as a surprise to the board, as at an inquiry by the Electricity Commissioners in 1930 it was stated that the Brentford and Chiswick Urban District Council had no intention of purchasing in 1934. This statement influenced the Corporation's policy as regarded capital expenditure which, as from the date of the inquiry until the date of the purchase, would amount to £25,000, of which sum much would be unproductive for some years.

Mather & Platt, Ltd., held their annual meeting on February 28th, when Mr. L. E. Mather (chairman), who presided, said the accounts made a better showing than seemed possible when the year closed, a year which had caused them more anxiety than any for some years past, and they were able to recommend the same dividends as for the preceding year. While they suffered serious curtailment of production last year, the outlook had distinctly improved and they commenced the year with a larger volume of orders than a year ago. Their new "Mulsifyre" system for the extinction of oil fires with water only had already met with considerable success, and their Grinnell sprinkler system for ships was receiving the attention of the authorities. Their home business had shown a small expansion, though it was still some way behind the figures of normal years. The volume of overseas orders had been practically the same as a year ago, but prices generally had been deplorably low. They had maintained their position in India, which was their largest market, with an almost identical turnover, but this was much below the average of recent years. The situation with regard to Soviet Russia had been materially improved by the signing of the trade agreement, and with the improvement in the export of manufactured goods to Russia, they stood in an excellent position to obtain some share of the business to be offered. Their French company had continued to obtain some profitable business, and the returns from Holland, Finland and Egypt had improved, and in South America, Brazil was again helping to fill their order book.

The Telephone & General Trust, Ltd., reports a net profit of £93,235 for 1933, as compared with £95,873 for 1932. To this is added £33,996 brought in, making £132,232. The ordinary dividend for the year is maintained at 8 per cent. and £39,842 is carried forward. Meeting: March 15th.

The Llanelly & District Electric Supply Co., Ltd.—Presiding at the annual meeting held on March 1st, Mr. A. H. Beatty (chairman) said that the result for the year was an improvement in net revenue of £2,700, and this was after charging special expenditure due to storm damage, &c., amounting to £3,970. Various extensions of the transmission lines in the Llanelly and Gorseinon areas were carried out during the year, the bulk supplies to Carmarthen and Ammanford were commenced, and the conversion of the light railways to the trolley-bus system was completed. The sales of electricity by the company and its subsidiary, the Gorseinon Co., aggregated 26,143,000 kWh, an increase of 1,937,000 kWh, and the new consumers connected totalled 1,314, making the total 11,4[illegible]. New premises had been acquired in Llanelly and adapted as offices and showrooms.

The West Gloucestershire Power Co. reports a revenue for 1933 of £148,346, as compared with £131,712 in the preceding year, and a balance, after paying all outgoings, of £46,7[illegible]. Depreciation on hired appliances, etc., receives £2,328, and depreciation, etc., reserve £29,768, leaving £14,689, which is also transferred to this reserve. In the last accounts allowances were made for depreciation of plant, property and equipment, and it was stated that there was £26,080 to be provided out of future surpluses in addition to annual allowances. The transfer of £14,689 leaves £11,391 to be provided out of future surpluses. The sales of electricity rose from 32,427,985 to 37,289,72[illegible] kWh.

The company has decided to redeem its 5½ per cent. first mortgage debenture stock at 105 on September 15th next. In replacement £550,000 four per cent. first mortgage sinking fund debenture stock will be created and offered to existing holders of the 5½ per cent. first mortgage debenture stock, who will be given preferential rights to convert into the new stock up to the amount of their present holdings. Cash applications are invited from the holders of the old stock and the holders of preference and ordinary stocks to subscribe for any balance of the new 4 per cent. first debenture stock not applied for under the conversion offer, at par.

Electric & Musical Industries has issued a circular giving details of a capital reduction scheme. The scheme provides for a reduction of the combined issued capital of the two subsidiary companies by £1,456,036 to £3,466,835, and the reduction of the parent company's ordinary capital by 50 per cent. to £2,902,874. It is proposed to reduce the £1 ordinary shares to 10s. each, and to carry the shares of the two operating companies into the parent company's balance sheet at a figure slightly below their reduced nominal value. The preference capital is unaffected. Upon the reduction of the capital of the parent company taking effect, the capital will be restored to its present amount of £6,266,000 by the creation of 5,806,000 new ordinary shares of 10s. each. The proposals will be submitted at an extraordinary meeting to be held on March 26th.

The Clyde Valley Electrical Power Co. reports a net profit for the year ended December 31st last of £368,885, as compared with £347,744 for 1932, which with £84,402 brought in mak[illegible] £453,287 available. It is proposed to pay a final ordinary dividend of 4 per cent., making 7 per cent. for the year, and to carry forward £88,287. The report states that a contributory superannuation fund has been established for the staff and to inaugurate the fund the sum of £52,000 has been contributed by the company from the staff benevolent fund. The distribution system has been further developed by an additional twenty-six miles of cables and overhead lines and twenty-nine sub-stations, while eleven sub-stations are under construction. Application has been made to the Secretary of State for Scotland for a Provisional Order to confer further powers upon the company, to extend the area of supply and for other purposes. Meeting: March 20th in Glasgow.

The Shanghai Electric Construction Co., Ltd., reports a profit for 1933 of £133,763, as against £115,511 in the preceding year, which with £24,819 brought in makes £158,582. After making provision for renewals (£40,000), taxation (£25,000), and contributing £2,148 to the Shanghai staff provident fund, it is proposed to pay a final dividend of 7 per cent., making 11 per cent. for the year, and to carry forward £25,434. As managers of the Singapore Traction Co., Ltd., the company participates in the profits of that company for the year ended September 30th last, to the extent of £4,000. Following the annual meeting on March 14th, an extraordinary general meeting will be held, at which resolutions will be submitted for transferring the control of the company to Shanghai.

The Isle of Thanet Electric Supply Co., Ltd., reports a revenue for 1933 of £168,861, as compared with £168,230 in the preceding year, and working expenses of £95,003, against £97,727. After deducting debenture interest, &c., transferring £30,000 to general reserve and depreciation, and adding £3,801 brought in, there is a balance of £28,726 (£26,721). The ordinary dividend is maintained at 4 per cent., less tax, and £5,806 is carried forward. Meeting: March 14th.

The National Gas & Oil Engine Co., Ltd., reports a loss for 1933, after allowing for depreciation of buildings, plant, machinery, &c., of £6,179. A balance of £540 is brought in, and to this is added £6,500 transferred from reserve. After deducting the loss for the year, a balance of £860 is carried forward. The report states that trade conditions were difficult during the first six months of the year, but there was an improvement during the latter half.

Grosvenor Electric Batteries, Ltd., announces that it has under consideration an arrangement that will, in its opinion, benefit the shareholders. It is unable to make a statement until early in May next, and advises shareholders not to sell any shares in the meantime. No ordinary interim dividend will be paid. Last year an interim dividend of 5 per cent. was paid but there was no final distribution.

The Mid-Cheshire Electricity Supply Co., Ltd., has declared a dividend of 8 per cent. on the ordinary shares, less tax, for 1933 (same).

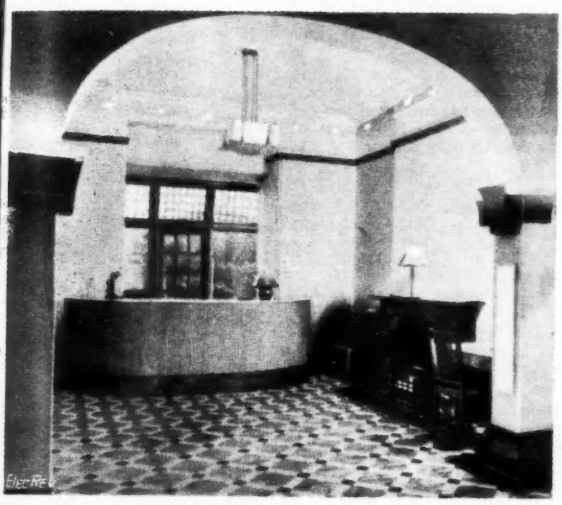
The Norwich Electric Tramways Co. has declared an interim dividend of 2½ per cent., less tax (same).

The Bournemouth & Poole Electricity Supply Co., Ltd. recommends a final ordinary dividend, subject to audit, of 9 per cent., maintaining the distribution for the year at 12 per cent.

The Richmond (Surrey) Electric Light & Power Co., Ltd. has announced a final ordinary dividend (subject to audit) of 7 per cent., making 11 per cent. for the year (same).

The Metropolitan Railway Co., announces that the amount available for distribution as a final dividend for the half-year ended June 30th, 1933, on the consolidated stock will permit of a payment at the rate of 0.4344 per cent. (approximately 8s. 8d.), less tax.

The Electrical Distribution of Yorkshire, Ltd., held its annual meeting at Leeds on March 6th, when Mr. R. W. Wickham (chairman), who presided, said that new demands had come from all parts of the area, which, as in the past, had been mainly for domestic purposes. The demand for supplies to new housing estates and for street lighting continued, and a large number of agreements had been made for the hire and hire-purchase of domestic apparatus. The substantial reduction in the cost of domestic apparatus in recent years was such that electricity could now be used for many purposes other than lighting by the small householder. Out of the 63,773 consumers at the end of 1933, no fewer than 17,628, or 28 per cent. of the total, were supplied through slot meters, and although the amount of electricity used in the small house and the return on the capital employed were small, they felt that the development of this class of business was justified not only from the financial point of view, but also because it brought to the small householder the social benefits which residents who were better off had enjoyed for many years. The company's low charges were fully appreciated by most of the local authorities of the districts which they served, but there had been a few instances where complaints had been received. Their critics must, however, always bear in mind that they were supplying a wide and scattered area with only 450 persons to the square mile. It was unfair to compare their supply with that of any of the compact and densely populated cities or boroughs of the West Riding. The company realised that the trade depression had made everyone look for economies, and their returns showed that the domestic consumer had economised in the use of electricity. Like other public utility



The inquiry office at the headquarters of Electrical Distribution of Yorkshire, Ltd.

undertakings, they had been called upon in recent years to meet the burden of higher rates, and next year, by the recent quinquennial valuation, this item would be still further increased. So long as these external burdens of rates and taxes continued to grow so rapidly the possibility of further price reductions was bound to be postponed. Despite delays beyond their control good progress was being made in the development of the Mid-Cumberland area. Supply was first made available in the area at Cockermouth in October, 1932, and at the end of last year 1,187 consumers had been connected. In Penrith arrangements were being made to convert the system of supply from d.c. to a.c. It was proposed to extend the mains throughout the district, and a large part of this would be proceeded with without delay.

The London Electric Supply Corporation, Ltd.—Presiding at the annual meeting on March 6th, Mr. O. R. H. Burg (chairman), in the course of his speech, said that at the last meeting he had referred to a reduction in electricity charges and meter rentals, and stated that the full effect of these reductions would be experienced during 1933. The fact that their revenue had increased by £19,000, in spite of these reductions, was a justification of their policy in reducing charges whenever it was possible to do so. The sales of electricity in 1933 totalled 313,897,159 kWh, as compared with 293,480,406 kWh in the preceding year, an increase of nearly 7 per cent. The annual increase in their output had been maintained for several years and indicated satisfactory progress through a period of depressed trade and difficult conditions. During the last four years they had been engaged in laying down the standard system of 50 cycles. This had necessitated the dismantling and disuse of mains and apparatus which had become obsolete, and accounted for the item of £28,584 in the capital account. The original 10,000-V cable between the generating stations at Deptford and New Bond Street was made by the company at Deptford and laid in 1890. The last section of this cable remained in commission until November last, and had thus served for a period of forty-three years. This unique cable had been placed by the Board of Education among its exhibits at the Science Museum, South Kensington. The "all-in" domestic tariff continued to attract consumers, and their showrooms in Lewisham, situated in the centre of their residential area, were of great use in displaying to full advantage the various forms of electrical labour-saving apparatus for the home. They had evolved a scheme enabling a tenant or owner of a small house to obtain an installation without having to incur any initial outlay. He was provided with an installation at the company's expense and purchased it by means of a slot meter. This scheme was put into operation in May, and was gradually becoming popular. They had also had a full year's experience of the business tariff, which had resulted in this class of consumer using electricity on a greater scale than previously. Last year they practically completed the change in the frequency from 85 cycles to 50 cycles.

The Mersey Railway Co.—Presiding at the recent annual meeting Mr. J. Waddell (chairman) said that the continued depression of trade in the area served by the railway resulted in a decrease in the gross receipts during the first six months of 1933, but during the second half the receipts showed an increase over the corresponding half of 1932. During the latter half of 1933 considerable improvement in traffic was experienced and since January 1st last they had been able to show increases each week in receipts, not only over last year, but also a slight increase over the corresponding period of 1932. This would appear to indicate that they had turned the corner, and while it was difficult to say what the future held the prospects were that 1934 would prove a better year for the company.

The Newcastle & District Electric Lighting Co., Ltd., reports a gross profit for 1933 of £70,510. To this is added £15,089 brought in, making £85,599. After deducting debenture interest and transferring £27,617 to depreciation reserve and £5,171 to general reserve, it is proposed to pay a dividend of 7 per cent., and to carry forward £15,732. The issue of 150,000 ordinary £1 shares offered to shareholders in March last year at 25s. per share was fully subscribed. The whole of the outstanding second mortgage debentures were redeemed on July 31st, 1933, at the rate of £105 per cent. Meeting: March 16th, at Newcastle-upon-Tyne.

The General Electric Co. (of New York), has increased its quarterly dividend from 10 cents to 15 cents per share. The New York correspondent of the *Financial Times* reports that for 1933 the company earned 38 cents per share against 41 cents in 1932, the net income totalling $13,430,000, against $14,404,000. Sales billed in the fourth quarter of 1933 amounted to $39,211,000, as compared with $34,112,000 a year ago. The orders booked in the last quarter were the largest for any three months since the second quarter of 1929, and exceeded the shipments for the first time since 1929.

Cammell Laird & Co., Ltd., report a net profit for 1933, after charging depreciation amounting to £31,876. This, with £741 brought in, will enable interest at the rate of 2½ per cent. to be paid on the first and third debenture stocks on May 1st. A balance of £3,005 is carried forward. The second debentures were redeemed during the year.

Stocks and Shares

Tuesday Evening.

THE Stock Exchange markets which deal with gilt-edged stocks, home railway issues and industrial shares are having what may be called a hectic time. It seems anomalous enough to find business going on at full swing in half of the Stock Exchange, while the remaining half, devoted to mining shares, is somewhat neglected. The appetite of the investor, so far from being satiated by the accumulation of stock that has been going on now for months past, appears to be more sharply set than ever. Rises in fixed-interest securities during the past fortnight have been on a scale really remarkable. The overflow of money has swept into its purview most of the home railway stocks, including those of the prior-charge groups. Industrials are in high favour. People are paying for these such prices as afford a lesser yield than that offered by gilt-edged stocks. Speculation plays a large part in this feverish activity, but the weight of money is not to be gainsaid, and, so long as capital is eager to secure employment, the difficulty is to see where the present movement is likely to stop.

Electricity Supply Shares

The boomlet in gilt-edged securities has been followed closely by an all-round improvement in the prices of industrial stocks and shares that have any claim to be regarded as sound investments. The ordinary shares of the London electricity supply companies fall, of course, within this category. Once more the group in our tables presents a list of rises which follow, it may be recalled, upon an equally long catalogue in last week's issue. On the basis of the 7½ per cent. dividend which, thanks to the example of the St. James' Company, is now expected likely to prove the standard dividend for 1934, the yield at 35s. comes to £4 4s. 6d. per cent. It would appear from this argument that prices still present scope for a further appreciation, at any rate to the extent of a shilling or so. Metropolitan Electric at 57s. are 9d. higher, it being said that the company is about to extend the area of its operations. County of London ordinary are up a florin at 59s. 6d., North Metropolitans recovered the dividend deduction; and the tale can be extended by reference to other shares in this section.

Provincial and Colonial

Provincial electricity supply shares are similarly strong. Yorkshire Electrics are practically 50s., and Electrical Distribution of Yorkshires are exactly that price. Midland Counties retain their rise at 40s. At the annual meeting of shareholders held this week the chairman referred to the company's three stations, which are amongst those to fill key positions in the Central England area over which the grid system is about to become operative. West Gloucestershire Power at 69 has risen

several points. Edmundson's ordinary are 43s. 6d., which is rather better. Newcastle and District strengthened to 39s. North Wales Power shares are being wanted on the basis of half a guinea. There are not many available, nearly all the shares being held by the British Power & Light Company. The price of the latter company's shares stands at 20s. 6d.

The recently offered East African Electrics are 6d. harder at 4s. premium. Victoria Falls ordinary shares put on 5s., advancing to 5⅞.

Central Electricity and Gilt-edged Stocks

The Central Electricity Board announces that on the first of next month trading operations under a grid tariff will come into force in the Central England area. This is in accordance with the programme laid down by the Board, and of its importance no doubt can be entertained. Amongst the generating stations in the area is a new "selected" station which has been built at Ironbridge by the West Midlands Joint Electricity authority. Central Electricity stocks are generally better. Rises of a point or so are shown in the various issues—the supply of which, by the way, is running short. West Midlands J.E.A. 5 per cent. stock at 112 is ex dividend. London Passenger Transport stocks are better, in company with the securities of the Home Railway market as a whole. To give an idea of the way in which good stock is sought nowadays, it may be of interest to mention that a line of £100,000 London Passenger Transport "A" stock came on offer a few days ago at 127. As soon as this became known, buyers appeared in sufficient number to absorb £80,000 of that stock within the course of an hour and a half. Galloway Power 4 per cent. debenture is a point up at 2½ premium. Southern Railway stocks have gone ahead materially. The chairman at last week's annual meeting of proprietors laid stress upon the important part played by electrification of the line in the company's recovery. He said that fresh extensions were soon to be started.

London Passenger Transport

Lord Ashfield has been speaking this week upon the subject of the London Passenger Transport Board, of which he is, of course, the chief, and pointing out how small is the margin of profit that the Board earns upon its enormous undertaking. He mentioned that the prior charge stocks account for 79 per cent. of the issued capital, the "C"—that is, the ordinary stocks—being only 21 per cent. of the whole, a lop-sided arrangement, the effect of which is to react sharply upon the dividend available for distribution to the "C" stockholders. The capital of the Board is £109,000,000, and the expenditure of another £18,000,000 will have to be faced sooner or later. Apart from income tax, the Board pays, said Lord Ashfield, nearly 2½ million pounds per annum in the way of rates, taxes and licence duties.

Cables and Wireless

The impression that President Roosevelt intends to extend his policy in the direction of quickening America's overseas trade is responsible for greater attention being paid to Cables and Wireless stocks. The 5½ per cent. preference has gained 2⅛, advancing to 73½: the ordinary stocks are both better on the week. An interesting theory, to explain the rather disappointing character of the monthly returns, suggests that development of the air mail services may be affecting the receipts of the communication companies. Globe Telegraph preference rose 5s. to 13 in the search for investments. American Telephone and Telegraph shares are 1 higher; Internationals, at 14, are 1 down. Great Northern Telegraphs have started to recover from their recent weakness. Marconi Marines picked up to 28s. 9d. in sympathy with improvement shown by shipping shares.

Equipment and Manufacturing

British Insulated, Callender's and Henley's led the way in an all-round revival in the prices of manufacturing companies' shares. Inquiry spread rapidly to the whole list. Enfield Rolling Mills at 31s. 9d. are 2s. 3d. higher. Arons rose to 56s., Johnson & Phillips to 21s. 9d., and Siemens to £1. Ever-Ready new shares, which had dropped to a few pence discount, recovered to "par": the senior issue at 29s. shows a slight decline, but Ever-Ready Trusts are better at 24s. 9d. Of the fixed interest stocks, Johnson & Phillips 4½ per cent. debenture is 10s. higher at 102.

Miscellaneous Matters

The most spectacular movement this week is a rise of 70 points in the deferred ordinary stock of the British Electric Traction Company. The number of transactions officially recorded day by day is surprisingly large, in view of the "heavy" nature of the stock. The buyers maintain that 700 is not too much to anticipate, considering the present value of the B.E.T. holdings. In the Canadian stocks, rises have occurred in British Columbia Power A to 31¼, and Montreal Light & Power to 36¼. Shawinigan Water reacted to 22 after touching 23.

Babcock & Wilcox advanced to 45s. 6d. upon hopes of a satisfactory final dividend. The Electric & Musical Industries has called a meeting for March 28th to approve a resolution for writing off £2,902,874 of ordinary share capital. This will reduce the nominal value of the shares from 20s., the present denomination, to 10s. Rubber shares are better on account of a rise in the price of the product.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1931.	1932.	Price. Mar. 6.	Rise or Fall.	Yield. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	78/9	+6d.	3 16 0
Brompton Ordinary	1	8½	7	34/6	—	4 1 2
Charing Cross Ordinary	1	8½	7	35/6	+6d.	3 19 0
Chelsea	1	8⅞	7	34/6	—	4 1 2
City of London	1	10	7½	36/3	+6d.	4 2 6
Clyde Valley	1	7	7	42/-	+9d.	3 6 8
County of London	1	10½	10½	59/6	+2/-	3 10 6
Edmundson's 7% Pref.	1	7	7	34/-	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	2½	+⅛	3 12 0
Elec. Supply Corporation	1	11	11	77/6	+⅛	2 16 8
Kensington Ordinary	1	8	7	35/6	+6d.	3 19 0
Lancs Light and Power	1	7	7	37/6	—	3 14 8
London Electric	1	9	7	35/6	+6d.	3 19 0
Metropolitan	1	10	10	57/-	+9d.	3 10 3
Midland Counties	1	7	7	2	—	3 10 0
Mid. Elec. Power	1	8	8	43/9	—	3 13 0
North Eastern Electric Ordinary	1	6	6	36/-	+6d.	3 6 8
Do. 7% Pref.	1	7	7	34/-	—	4 2 4
Northampton	1	10	10	57/6xd	+1/9	3 9 6
Notting Hill 6% Pref.	10	6	6	13⅜	—	4 8 11
North Met. Elec. Ordinary	1	—	10	3⅛xd	+1/-	3 0 5
Do. do. 6% Pref.	1	6	6	30/-	—	4 0 0
St. James' and Pall Mall	1	8	7	36/-xd	+⅛	4 3 4
Scottish Power	1	8	8	2	+⅛	3 13 1
South London	1	8½	7	35/-	+6d.	4 0 0
Westminster Ordinary	1	8½	7	35/-xd	+9d.	4 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/-	—	6 16 4
Yorkshire Elec.	1	8	8	49/9xd	+1/9	3 4 3
Public Boards.						
Central Electricity, 1950–70	Stock	5	5	112	—1	4 9 3
Do. 1955–75	„	5	5	113xd	—	4 8 6
Do. 1951–73	„	4½	4½	108	+1	4 3 4
Do. 1963–93	„	—	3½	95½	+1	3 13 4
London & Home Counties, 1955–75	„	4½	4½	109	—	4 2 7
London Passenger Transport, A	„	—	4½	118½	+1½	3 16 0
Do. do. B	„	—	5	123	+2½	4 1 4
Do. do. C	„	—	—	83	+1	—
West Midlands Joint Elec. 1948–68	„	—	5	112xd	—	4 9 3
Telegraph and Telephones.						
American Tel. & Tel.	$100	9	9	121½	+1	7 8 9
Anglo-Am. Tel. Pref.	Stock	6	6	113	—	5 6 2
Do. Def.	„	1½	1½	28	—	5 7 2
Cables & Wireless 5½% Pref.	„	2⅜	2⅜	73½	+2½	3 14 10
Do. A 7½% Ord.	„	Nil	Nil	24	+1	—
Do. B. Ord.	„	Nil	Nil	11	+½	—
Globe Tel. and T. Ord.	10	Nil	2½	10	—	2 10 0
Do. do. Pref.	10	6	6	13	+½	4 12 4
Great Northern Tel.	10	20	20	36	+½	5 11 1
Marconi-Marine	1	10	7½	28/9	+⅛	5 4 2
Oriental Telephone Ord.	1	12	12	3½	—	*3 16 10
Home and Foreign Trams, Etc.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	2/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	„	5	5	560	+70	—
Do. do. Pref. Ord.	„	8	8	152½	—	5 5 0
Brazil Traction	100	—	—	11⅞	—⅛	—
Brit. Columbia Elec. Rly. Pfe.	Stock	5	5	102½	—	4 17 6
Mexico Trams, 5% Bonds	—	5	5	19½xd	—	25 12 8
Mexican Light Common	100	Nil	Nil	8	—	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	47½	—	10 10 6
Victoria Falls Ord.	1	15	20	5⅞	+⅛	3 12 0
Yorkshire (West Riding)	1	Nil	Nil	1	+⅛	—
Manufacturing Companies.						
Assoc. Elec. Ord.	1	4	4	19/3	—6d.	4 3 2
Do. Pref.	1	8	8	31/3	—	5 2 5
Babcock & Wilcox	1	14	9	45/6	+1/-	—
British Aluminium Ord.	1	5	5	32/-	—	3 2 6
British Insulated Ord.	1	15	15	72/6	+⅛	4 2 8
Brush Ord.	Stock	Nil	Nil	40	—	—
Callender's	1	15	15	62/6	+⅛	4 16 0
Do. 6½% Pref.	1	6½	6½	30/9	—	4 4 6
Crompton Parkinson Ord.	5/-	22½	12½	25/-	—	—
Do. 8% Pref.	1	8	8	31/3	—	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	10/-	—	—
Enfield Cable Ord.	1	25	25	87/6	—	4 11 4
English Electric	1	Nil	Nil	6/3	—	—
Do. do. Pref.	1	Nil	Nil	8/9	—	—
Ever Ready	5/-	35	35	29/-	—	6 0 8
Ferranti Pref.	1	7	7	26/-	—6d.	5 7 9
G.E.C. Pref.	1	6½	6½	30/-	—	4 6 8
Do. Ord.	1	8	8	43/9	—	3 13 1
Henley's	1	30	30	6½	+⅛	4 16 0
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	15/-	—	—
Johnson & Phillips	1	5	5	2/9	+1/9	4 12 0
Siemens Ord.	1	7½	6½	1	+6d.	—
Telegraph Construction	£1	Nil	Nil	25/-	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings taken.

1932

12654. "Three-phase variable-speed commutator motors with variable torque." J. Sousedik. May 1st, 1931. (405652.)

13029. "High-frequency inductance devices." Johnson Laboratories Inc. May 7th, 1931. (405623.)

13231. "Electric regulating apparatus." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges.). May 7th, 1932. (405665.)

13246. "Arrangement for the supply of current to, and the regenerative braking of, direct current motors." Siemens-Schuckertwerke Akt.-Ges. August 11th, 1931. (405638.)

13468. "Method of charging accumulator batteries." Compagnie Général d'Electricité. June 26th, 1931. (405667.)

15821. "Electric discharge devices and the use thereof." Siemens Electric Lamps & Supplies, Ltd., J. N. Aldington and P. D. Oakley. June 4th, 1932. (405640.)

18655. "Power electric magnets." Igranic Electric Co., Ltd., and J. R. Taylor. July 1st, 1932. (405628.)

18682. "Luminous electric discharge tubes." General Electric Co., Ltd., V. J. Francis and J. W. Ryde. July 1st, 1932. (405605.)

20699. "Electric heating elements and machine and process for producing same." J. E. Smith. July 22nd, 1932. (405611.)

21248. "Protective arrangements for electrical apparatus." International General Electric Co., Inc. July 27th, 1931. (405614.)

21351. "Electric switches for electric motor control." British Thomson-Houston Co., Ltd., and H. F. Jefferson. July 28th, 1932. (405644.)

21892. "Automatic electric battery charging control or indicator." G. Taylor. July 28th, 1933. (405704.)

22168. "Electrical connectors and the manufacture thereof." C. R. Cook. August 8th, 1932. (405649.)

22388. "Method of and means for operating incandescent electric lamps or like electrical apparatus containing incandescent bodies." F. Skaupy. August 15th, 1931. (405683.)

22411. "Means for the transmission of power from an electric motor to a sewing-machine or other machine." J. Cook, jun., and J. Cook. August 10th, 1932. (405684.)

23493. "Systems of electric motor control." British Thomson-Houston Co., Ltd. August 21st, 1931. (405720.)

24496. "Directional radio-transmitting arrangements, particularly for use with ultra-short waves." C. Lorenz Akt.-Ges. April 19th, 1932. (405727.)

24736. "Electrical instrument transformers." J. H. Buchanan and Associated Electrical Industries, Ltd. September 5th, 1932. (405729.)

24934. "Electrical couplings." C. B. Colston. September 7th, 1932. (405733.)

25362. "Fusible electric cut-outs." English Electric Co., Ltd., and A. M. Pooley. September 12th, 1932. (405739.)

25515. "Telephone systems." Siemens Bros. & Co., Ltd., and E. W. Durkin. September 14th, 1932. (405741.)

26254. "Insulation of windings on high-tension dynamo-electric machinery." G. R. Shepherd (Westinghouse Electric & Manufacturing Co.). September 21st, 1932. (405744.)

26611. "Electric indicators for use in connection with electrical appliances and apparatus." A. B. Klein. September 24th, 1932. (405746.)

27487. "Manufacture or production of dollies or tumblers for electric tumbler switches." J. A. Crabtree and B. G. Harrison. October 4th, 1932. (405750.)

29446. "Sound-reproducing apparatus such as loud speakers." General Electric Co., Ltd., and F. H. Brittain. October 21st, 1932. (405754.)

29939. "Electric rotary converters." J. C. Macfarlane, W. A. Macfarlane and G. Austin. October 26th, 1932. (Cognate application 11425/33.) (405759.)

31850. "Short-wave radio apparatus." H. G. C. Fairweather (Hazeltine Corporation). November 10th, 1932. (405768.)

31977. "Alternating-current electric switches." J. Anderson. November 11th, 1932. (405769.)

33143. "Means for eliminating undesirable harmonics in electrical circuits." British Thomson-Houston Co., Ltd., and R. T. Coe. November 23rd, 1932. (405773.)

33594. "Oil switches for high-power electric circuits." Harland Engineering Co., Ltd., F. G. Warburton, G. Caton and P. J. Pengelly. November 28th, 1932. (405776.)

34715. "Supports for electric meters." Edison Swan Electric Co., Ltd., and F. Shergold. December 7th, 1932. (405780.)

36539. "Mirror wheels for television." H. Papst. December 23rd, 1931. (405783.)

1933

1657. "Electric lamp shades and fittings applicable also to other purposes." S. W. Hamlyn and Dernier & Hamlyn. January 18th, 1933. (405793.)

7821. "Structural combinations of capacities and inductance coils, particularly for wireless signalling." H. Vogt. March 24th, 1932. (Cognate applications 7822/33 and 7823/33.) (405820.)

8289. "Television system." W. H. Peck. March 18th, 1933. (405821.)

10660. "Transformer protection." S. H. Eckmann. April 10th, 1933. (405828.)

10993. "System of transmission for duplex telegraphy." Siemens and Halske Akt.-Ges April 18th, 1932. (405830.)

11156. "Switching devices for X-ray tubes." C. H. F. Muller Akt.-Ges. April 13th, 1932. (405832.)

15137. "Igniting devices for metal-vapour rectifiers, particularly a dipping-igniting device for glass-bulb rectifiers." English-Electric Co., Ltd. September 14th, 1932. (405857.)

16386. "Internal-combustion engine electric power units for vehicles." Sulzer Frères Soc. Anon. June 24th, 1932. (405863.)

17969. "Devices for feeding electron-discharge tubes." C. H. F. Muller Akt.-Ges. July 11th, 1932. (405877.)

19652. "Method of treating viscous insulating materials." International General Electric Co., Inc. July 13th, 1932. (405885.)

21087. "Connection systems for Braun tubes." M. Von Ardenne. July 28th, 1932. (405892.)

21162. "Thermionic amplifiers suitable for use in radio and like modulated carrier-wave receivers." Marconi's Wireless Telegraph Co., Ltd. July 27th, 1932. (405894.)

22792. "Electrolytic deposition of nickel from nickel salt solutions." Falconbridge Nikkelverk Aktieselskap. August 27th, 1932. (405902.)

23807. "Electro-medical apparatus." C. R. Little. August 28th, 1933. (405912.)

23868. "Windings for induction furnaces." British Thomson-Houston Co., Ltd. August 26th, 1932. (405913.)

24043. "Flywheel magnetos for internal-combustion engines." P. C. Schriek and J. J. H. Beijerman (trading as Bilthovensche Metaal Industrie). August 30th, 1932. (405914.)

25694. "Thermionic valve oscillation generator arrangements." Marconi's Wireless Telegraph Co., Ltd. October 7th, 1932. (405920.)

28225. "Vacuum electric switches." British Thomson-Houston Co., Ltd. October 12th, 1932. (405931.)

28610. "Alternating-current rectifying apparatus." British Thomson-Houston Co., Ltd. October 14th, 1932. (405932.)

28611. "Arc-extinguishing chambers for electric switches." British Thomson-Houston Co., Ltd. October 14th, 1932. (405933.)

29494. "Metal-vapour rectifiers." English Electric Co., Ltd. October 24th, 1932. (405934.)

31857. "Apparatus for detecting the presence of mercury vapour." British Thomson-Houston Co., Ltd. November 16th, 1932 (405937.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 28th :—

Copsol. No. 547018. Class 5. Solder.—Metropolitan-Vickers Electrical Co., Ltd., Bush House, Aldwych, W.C.2.

Ever Ready (lettering and design). No. 534607. Class 8. Dry batteries and cells, and accumulators (not for medical purposes). No. 534608. Class 11. Lamps (electrical), dry batteries and cells, accumulators and coils, all for medical or dental purposes. No. 534609. Class 13. Electric lamps, and lamp and torch cases. No. 534610. Class 14. Nickel-plated electric lamp cases.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N.7.

Mars Radio (lettering and design). No. 545923. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof.—Mains & Allied Radio Supplies, Ltd., 41-43, Baker Street, W.1.

Aldinol. No. 545313. Class 50. Electrical insulating substances of asbestos, mica or bitumen sold in sheet form.—Société des Accumulateurs Electriques (Anciens Etablissements Alfred Dinin), Nanterre (Seine), France. (British representatives: Wheatley & Mackenzie, 40, Chancery Lane, W.C.2).

In the Courts

IN the House of Lords, consisting of Lords Tomlin, Russell of Killowen, and Wright, the hearing was continued on March 1st of the appeal by Radiovisor Foreign & Colonial, Ltd., from the judgment of the Court of Appeal affirming the judgment of Mr. Justice Lawrence in the King's Bench Division, dismissing the action which the appellant company brought against Radiovisor Parent, Ltd., claiming £200,000 damages and the return of 100,000 £1 shares.

Mr. Miller, continuing his argument for the appellants, said his case was that Mr. Neale and Mr. Clutterbuck of the Parent Company had made the following representations which they knew to be untrue : that the resistance of the bridge remained constant under the same intensity of light over a long period of time, and that its resistance varied only with varying degrees of light; that each bridge could be manufactured for about 2s. 6d.; that the manufacture of the bridge could be commenced forthwith by mass production methods without further experiment; that it could be made with any reasonable degree of sensitivity; and that during the whole time that an installation at Barnes had been working not a single bridge had failed to operate or had been changed.

He (Counsel) submitted that the House was not bound by the finding of Mr. Justice Lawrence that those representations were not fraudulently made, and certainly not so far as Mr. Neale was concerned because he was not present to give evidence at the trial of the action.

At the conclusion of the arguments on March 6th their Lordships reserved judgment.

Damage to an Overhead Line

At the Leeds Assizes on March 2nd four linesmen employed by the Central Electricity Board, who had been committed for trial from the Otley (Yorks) Police Court, were charged with maliciously damaging one of the Board's lines on the Kirkstall-Harrogate section of the grid. The police court proceedings were reported in our last issue.

All four pleaded guilty. Mr. Snowden, for the prosecution, said that the men were dissatisfied with their wages and sought to cause overtime employment by arranging a breakdown of supply. A length of copper wire was thrown over the lines but fouled only one circuit, thus failing to cause a complete breakdown. The Central Board was not desirous of having the men sent to prison.

The accused were bound over for a period of two years.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashby-de-la-Zouch.—Cottage hospital, extensions (£3,500); Orton & Son, builders.

Bath.—Employment exchange for H.M. Office of Works, King Charles Street, London, S.W.

Bedford.—Houses (14), Rosamond Road; E. H. C. Inskip & Son. Mental colony, Bromham (£110,000); Bedfordshire and Northamptonshire Joint Committee.

Billingham-on-Tees.—Houses (125); J. J. Hill, U.D.C. surveyor. Public swimming baths (£13,478); Kitching & Co., U.D.C. architects, 21, Albert Road, Middlesbrough.

Birmingham.—Houses (120), Priory Road; Linnecor & Sons, builders, 156, Newtown Row. Additions to bakery department, Great Brook Street, for the Co-operative Society, High Street; Building Dept., Co-operative Society, Woodcock Street.

Blackpool.—Extensions to central premises, Corporation Street and Sheppard Street, for the Co-operative Society, Ltd.; Architect's department, Co-operative Wholesale Society, Ltd., Balloon Street, Manchester.

Bolton.—Additions to works for Musgrave Spinning Co., Ltd., Atlas Mills, Chorley Old Road; William Townson & Sons, Ltd., builders, Park Hill Street.

Boston.—Senior school (400 places), for Borough E.C.; J. R. McKnight, director of education.

Buckinghamshire.—Senior school, Buckingham, for County E.C.; director of education, Aylesbury. Extensions to mental hospital, including admission hospital, &c.; county architect, Aylesbury.

Burton-on-Trent.—Senior schools, Clarence Street, for Borough E.C.; director of education.

Bury St. Edmund's.—School (400 places) for Borough E.C.; J. H. Wakefield, secretary.

Cambridge.—Senior schools (720 places), for Borough E.C.; director of education.

Cambuslang (LANARKSHIRE).—Rebuilding cinema for the Cambuslang Picture House Co., Ltd. (£10,000); the secretary.

Carlisle.—Central schools, Swifts, for E.C. (£40,000); P. Dalton, city architect, 18, Fisher Street.

Cheltenham.—Houses (14), Hatherley Road; Wheeler & Mansell. Houses (156), Tewkesbury Road; borough engineer.

Cheshire.—Child welfare centre, Sale, for County E.C.; F. A. Browne, county architect, the Castle, Chester.

Chesterfield.—Factory, Brampton, for Robinson & Sons, Ltd.

Crewe.—Development of estate, Waterloo Road, Haslington, for houses; T. Sims-Hilditch, architect, Harmel House.

Colchester.—Houses (46), Ipswich Road; borough engineer. Head post office, Head Street, for H.M. Office of Works, King Charles Street, London, S.W.

Consbrough.—Houses (100); H. Thirlwall, Council surveyor.

Darlington.—Houses (75); J. Pallister, R.D.C. surveyor.

Derby.—Houses (100), Cowsley; C. H. Aslin, borough architect, Gower Street.

Dumfries.—Extensions to bazaar premises, High Street (£2,300), for F. W. Woolworth & Co., Ltd., London.

Durham.—School, Hurworth, for County E.C.; A. H. Earnshaw & Sons, builders, Cleveland Buildings, Darlington. School, Lanchester, for County E.C.; R. Gallagher, Ltd., builders, Cemetery Road, Blackhill. R.C. schools, Springwell Hall and Norton; R. Burke, architect, 12, Grey Street, Newcastle-on-Tyne.

Easington.—Houses (122); C. W. Clarke, R.D.C. surveyor.

Eastbourne.—Houses (44), Queen's Road; Eastbourne House Builders' Association.

Edinburgh.—Houses (55) and shops, for Dean Property Investment Co., Ltd., 51, Queen Street; Stewart Kaye, architect, 14, Hill Street.

Eggborough.—Houses (60); Pennington, Hustler & Taylor, 45, Ropergate, Pontefract.

Enfield.—Houses (300), Freezywater, Padnall Estates, Ltd., for Reynolds Development Co. Estate development in the vicinity of Slades Hill; A. E. Little.

Essex.—Library, Chingford (£5,863), for County E.C.; Hosking & Son, builders. Schools, Woodford (£38,656), and Harold Wood, and extensions, Leyton High School for Boys, for County E.C.; director of education, Chelmsford. Extensions, hospital and X-ray department, Romford (£16,000); county architect, Chelmsford.

Eton.—Houses (110); R.D.C. surveyor.

Fifeshire.—School, Dunfermline (£85,000); G. Sandilands, Master of Works, County Council, Cupar, Fife.

Gateshead-on-Tyne.—Houses (80); R. Barron & Sons, builders, Coundon, near Bishop Auckland, Durham.

Glasgow.—Addition to works for the British Oxygen Co., Ltd., Aikenhead Road, Polmadie; Gardner & Gardner McLean, architects, 134, Bath Street. Extensions, Hawkhead Mental Hospital; architect, Office of Public Works, City Chambers.

Guildford.—Cinema, Hugh Street; National Provincial Picture Houses, Ltd.

Halesowen.—Houses (150); U.D.C. surveyor.

Hampton.—Extensions to waterworks, with plant (£365,000), for the Metropolitan Water Board, 173, Rosebery Avenue, E.C.

Hastings.—Houses (33), Baldslow Estate, for Golbie & Green, Berkeley Square, London, W.1.

Hatfield.—Houses (50); R.D.C. surveyor.

Hemel Hempstead.—Houses (50), Wood Lane; A. Murray-Smith, borough engineer, Market Square.

High Wycombe.—Houses (318); M. J. Gleeson, Ltd., builders, Sheffield.

Holmfirth.—Receiving block, treatment and casualty wards, &c., Holme Valley Memorial Hospital, Elmwood; P. N. Brown, architect.

Horley (SURREY).—Cinema, for King & Shipman.

Hull.—Houses (1,000), Cold Harbour Lane; Wellsted, Dossor & Wellsted, architects.

Huddersfield.—Houses (100), and cubicle block and extensions to nurses' home, Mill Hill Isolation Hospital; borough engineer.

Ilford.—Cinema, with ballroom and café (£100,000), for the Majestic Theatres (Ilford), Ltd.; S. B. Britlove, architect, 11, Ironmonger Lane, E.C.

Ilminster.—Factory extensions, Ditton Street, for Day, Foley & Co.

Inverness.—Houses (142); William Smith, architect, High Street.

Irish Free State.—(CASTLEBAR, Co. MAYO).—Electrical installation to doctor's residence, and at the residence of the superintendent of the Mental Hospital for the Committee of Management; P. J. Munden, 1, South Frederick Street, Dublin. (KILKEE, Co. CLARE).—Houses (32); P. J. O'Halloran, Town Clerk, 47, O'Connell Street.

Jarrow-on-Tyne.—Internal rebuilding of the Town Hall; J. S. Weir, borough engineer.

Keighley.—Houses (59), Woodhouse Estate (£17,877); Paul Rhodes, Ltd., Park View Works, Cardigan Road, Leeds.

Kidderminster.—Houses (40), Broadwaters Estate; borough engineer.

Kingston-on-Thames.—Bank, with lifts, Clarence Street and Church Street, for Barclays Bank, Ltd.

Lancaster.—Houses (50), Council Estate; Nicholson & Wright, Ltd.

Leeds.—Houses (120) and flats, Gipton Housing Estate; R. A. H. Livett, housing director, Civic Hall.

London.—(BERMONDSEY).—Flats, various estates (£30,000); B.C. Works department. (BRIXTON).—Extensions, School of Building (£22,963); J. & C. Bowyer, Ltd., Norwood, S.E. (FINCHLEY).—Houses (24), Abbotts Gardens; Comben & Wakeling, Ltd. (HAMMERSMITH).—School (800 places); L.C.C. architect. (HAMPSTEAD).—Houses (27), Howard Walk, Garden Suburb; G. C. Swanson. (HITHER GREEN).—Extensions to Park Hospital (£5,790), for London C.C. (PADDINGTON).—Flats, Westbourne Terrace and Orsett Terrace; Housing Corporation of Gt. Britain, Ltd. (STEPNEY).—Extensions, St. Bernard's R.C. School, Baker Street; Canon T. J. King.

Luton.—Town Hall (£125,000); Bradshaw, Gass & Hope, architects, Bolton. School, Hart Lane (£17,000), for Borough E.C.; director of education.

Lytham St. Annes.—Gymnasium and manual room, King Edward VII School, Fairhaven, for the Governors of Lytham Schools Foundation; John Sutcliffe & Sons, builders, Alexandria Drive.

Manchester.—Rehousing (four estates) (£122,779); city architect.

Middlesbrough.—Church on the Marton Grove Estate; L. Moore, architect, Raymond Buildings, London, W.C.1.

Newcastle-on-Tyne.—Houses (32); Robson & Co., builders, Welbeck Road.

Northampton.—Houses (60), Balfour Road and St. Andrews Road; T. Wilson & Son, Ltd. Houses (256), Boothville Estate; Jordans, Ltd. Houses (48), St. David's Estate; borough engineer. Maternity hospital (£18,000); Queen's Institute Governors.

Paisley.—Houses (900); burgh surveyor.

Plymouth.—Houses (300), various sites; borough engineer. Reconstruction of Frederick Street and Wolsden Road schools, for E.C.

Ponders End.—Factory and house, Lincoln Way; Hamilton Son & Campion.

Preston.—Additions to the Royal Infirmary for the Board of Management (£35,000), with electrical installations; T. Croft & Sons, builders, Blackpool Road.

Redruth.—Theatre and cinema; L. Winn, architect.

Rotherham.—Houses (196); R.D.C. surveyor.

St. Helens (LANCS).—Houses, Leach Lane, for H. & J. Twist.

Saunton (BARNSTAPLE).—Hotel, for Christie Estate Trustees.

Severalls (ESSEX).—Cottages (54), mental colony (£18,000); county architect, Chelmsford.

Shipley.—Houses (24), Marion Drive; G. W. Neville.

Sittingbourne.—Power and boiler houses, Kemsley Paper Works, for Edward Lloyd, Ltd.

Slough.—Factory and office block, Slough Estates, Ltd. Fifteen blocks of flats, Salthill, for G. Davis.

Smethwick (STAFFS).—Houses (218), Warley Estate (£62,074); E. L. Lewis, builders, Redditch.

Southport.—Houses (154), Churchgate; Hesketh Estates, Ltd.

South Shields.—Houses (230), Quarry Lane; J. Reid, borough engineer.

Staffordshire.—Senior Council School, Stone (£14,550), with electrical work; Education Architect, Education Offices, Earl Street, Stafford.

Surrey.—Extensions to Ash Wyke Schools (£3,877), for County E.C.; A. E. Jones, Ltd., builders.

Sutton Coldfield.—Schools (£40,000), with electrical work; Education Offices, Council House.

Tewkesbury.—Hospital, for the Hospital Committee; secretary.

Trowbridge.—Cinema, Newtown, for H. Andrews.

Walsall.—Houses (99); borough surveyor.

Warrington.—Houses (60), Evelyn Street; borough engineer.

Welwyn (HERTS).—Houses (60), Welwyn & Woolmer Green; R.D.C. surveyor.

Weston-super-Mare.—Houses (76); U.D.C. surveyor. Houses (30); A. E. Lock.

Whickham-on-Tyne.—Houses (74); T. Fenbow, U.D.C. surveyor, Council Offices.

Whitby.—School, Westcliff Estate (£11,488); Mr. Hebditch, builder, Loftus-in-Cleveland.

Willenhall (STAFFS).—Council offices and fire station, Walsall Road; F. G. T. Webb, Town Hall.

Worcester.—Cinema, Foregate Street, for the P.C.T., Ltd., 123, Regent Street, W.1 (£30,000), with electrical work; W. E. Trent, staff architect.

Wrexham.—Houses (225); R.D.C. surveyor.

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PATENTS AND DESIGNS ACTS, 1907 TO 1932.

NOTICE is hereby given that EDWIN ARTHUR LENNOX, of 14, Westfields Road, Acton, London, W.3, seeks leave to amend the Complete Specification (including the drawings) of Letters Patent No. 383853 granted to him for an invention entitled "An Improvement in or relating to Arc Lamps."

Particulars of the proposed amendment were set forth in No. 2354 of the Official Journal (Patents), published on February 28th, 1934.

Any person, or persons, may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, within one calendar month from the date of publication of the said Journal.

M. F. LINDLEY,
Comptroller-General.
4546

ALTERATION OF

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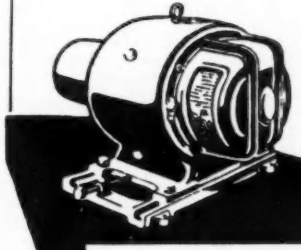

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COMPANY MEETING.

THE MIDLAND COUNTIES ELECTRIC SUPPLY CO., LTD.

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EXPANSION OF SERVICES.

THE twenty-first ordinary general meeting of the above Company was held on Monday, March 5th, at Winchester House, Old Broad Street, E.C. Mr. George Balfour, J.P., M.P. (the chairman), presided.

The Chairman, in moving the adoption of the report and accounts, said: The accounts we submit to-day will, no doubt, be regarded by shareholders as satisfactory, disclosing, as they do, a continuation of the steady progress which has been achieved in past years. Before I make any general observations, review the business of the past year, or deal with the accounts, I will make clear the position of the transport undertakings. You have, no doubt, noted in the directors' report the statement that "the whole of the traction properties have now been converted to bus or trolley systems, with satisfactory results." The current year is the first year that we operate wholly by petrol bus or trolley bus, the last of the tramcars having been taken off the road some months ago, and the loss on the cost of these services eliminated. We now operate on services over 550 route miles, and have gradually consolidated these services in a manner which should produce good results.

The result of the year's working provided a balance of £51,180, of which £45,680 was applied to depreciation and £5,500 was left in reserve, only a few hundred pounds being brought into the accounts of this company, so that the results shown in the accounts submitted to you to-day are attributable to the electricity supply business. The earnings of the transport undertakings so far this year show a considerable improvement compared with the same period last year.

Turning to our electricity supply business, we have made very satisfactory progress during the year. We have continued our business-getting campaign, and the results are reflected in the figures I shall mention. The increased revenue due to new business is £35,000 greater than shown in the figures I shall give you, due to the fact that, owing to rearrangement of old and satisfactory contracts which came up for revision, we had to face this heavy but anticipated reduction. We have no other similar contracts to deal with, and, therefore, the normal rate of increase this year will not be affected by such special items.

ELECTRICITY SUPPLY.

The Operating Companies' Power Stations generated 268,638,000 units, and 10,519,000 units were, in addition, purchased from other sources. The total units sold amounted to 236,531,000—an increase of 22,798,000 units over the previous year, or an increase of nearly 11 per cent.

NEW CONSUMERS.

We connected 11,352 new consumers during 1933, making the total number of consumers now supplied 62,885. The total of 62,885 is approximately three times the number of consumers supplied at the end of 1928; in other words, the number of consumers has been trebled during the last five years. During the year under review we connected an additional 21,149 kilowatts to the companies' mains, making the total connected load at the end of last year 202,121 kilowatts.

The maximum demand on the generating plant was 76,610 kilowatts, which, together with 2,140 kilowatts purchased, makes a total demand of 78,750 kilowatts.

To carry the supply to districts not hitherto served and to continue the development in districts already served, we provided during the year 113 miles of high tension lines, of which 9 miles were laid underground and 104 miles erected overhead. We have now in operation 1,309 miles of high tension lines, of which 413 miles are underground and 896 miles overhead. We also provided 179 miles of low tension distributors, of which 65 miles were placed underground and 114 miles carried overhead, bringing the total length of our low tension lines to 1,242 miles, of which 727 miles are underground and 515 miles overhead. The total length of the electric lines now in use is 2,551 miles.

FURTHER LIGHTING SERVICES.

During the year, supplies were inaugurated in one urban district and 59 parishes, and altogether the operating companies distribute electricity in three boroughs, 31 urban districts and 462 parishes in rural districts.

The average revenue per unit sold in the area of the Derbyshire and Nottinghamshire Power Company was approximately 0.69d. per unit, and, excluding bulk supply and very high load factor industrial consumers, the average received from all our miscellaneous industrial and domestic load was just over 1d. per unit. The average in the Leicestershire and Warwickshire area was 1.228d. per unit, the difference in the average being wholly accounted for by the difference in the characteristics of industrial load in the two areas. The average price per unit for all supplies over the whole of our area was 0.9d.

Turning to the revenue account, the gross trading profits of the subsidiary companies amounted to £538,853. There remains a balance at credit of revenue account of £313,854, which compares with £297,126 for the previous year. The directors propose the payment of a final dividend of 4½ per cent. on the Ordinary shares, making 7 per cent. for the year, less tax, and to carry forward to next account £6,609.

This year to date we are able to record a very satisfactory increase in revenue, and, with the growing recognition of an electricity domestic service due to reliability of apparatus, there should be ample room for expansion. 4569

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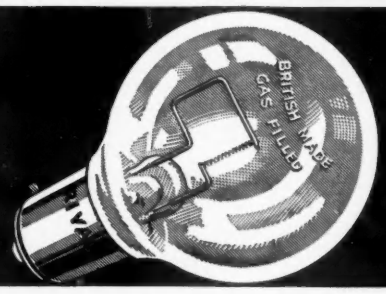

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